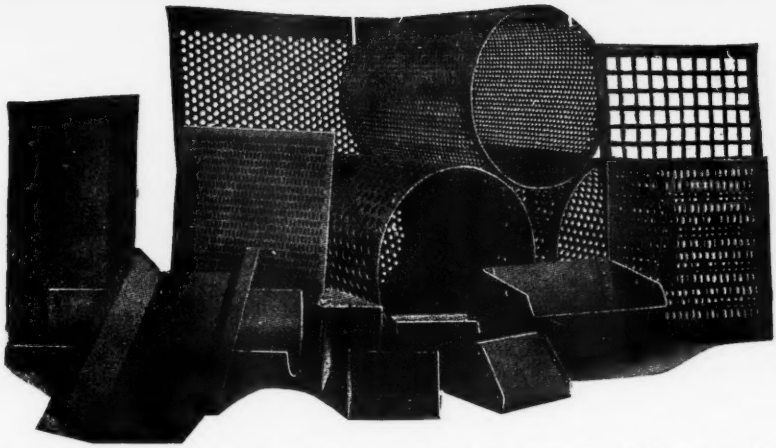
Pit and Quarry

SAND ▪ GRAVEL ▪ STONE

HANDLING ▪ CRUSHING ▪ SCREENING ▪ WASHING



"HENDRICK" PERFORATED METAL SCREENS

Built to meet your individual needs. Round, square or slotted perforations. Plates furnished flat, curved or flanged.

"HENDRICK" ELEVATOR BUCKETS

Made up for your requirements. One portion of our modern plant is well equipped to execute orders for buckets. A large stock of blank plates insure prompt shipment of orders placed with us.

Write for Perforated Metal Hand Book.

HENDRICK MANUFACTURING CO.

44 Dundaff St. CARBONDALE, PA.

Perforated Metal Screens
"Mitco" Interlocked Grating

Elevator Buckets
"Mitco" Shur-site Stair Treads

July 1, 1925

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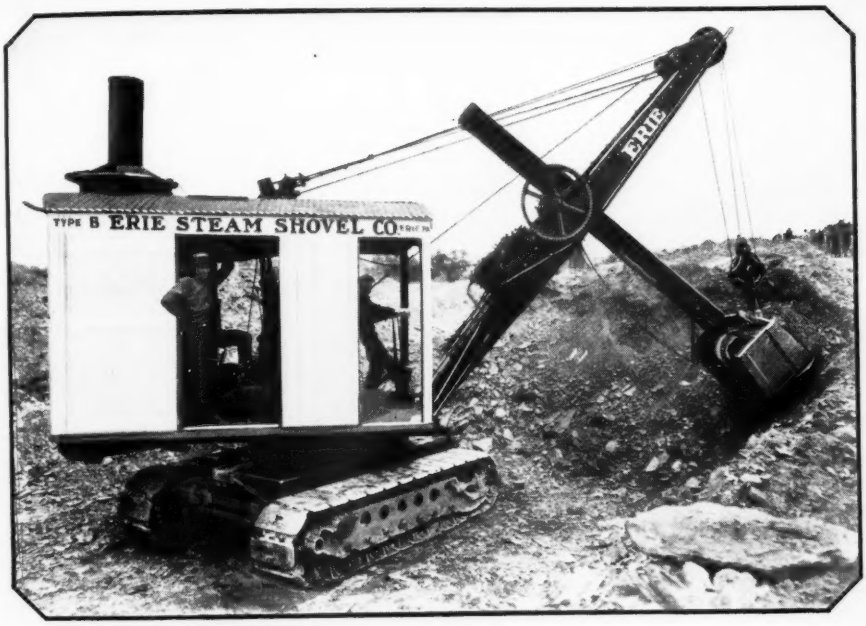
Table of Contents - - - - - - Page 41

Circulation 7,600

At last!
the perfect crane-shovel

INDUSTRIAL
CRAWLING TRACTOR CRANES

INDUSTRIAL WORKS · · · BAY CITY · MICHIGAN



Buying More and More Steam ERIES!

Do you know that ERIE Shovel sales for April and May, 1925, ran *ahead of the biggest April and May Sales in any previous year?*

There are now more than 3450 ERIES in service— and you know why! The quarryman who has "been through the mill" wants the shovel that *gets the work done*— and he knows from past experience which shovel that is.

ERIE reliability is what counts.

Once you have used an ERIE, and know how much better it really is *from actual comparisons*— the ERIE is what you will want to buy. "Repeat orders" (from old ERIE owners) have been larger to date in 1925 than during the same period of any previous year.

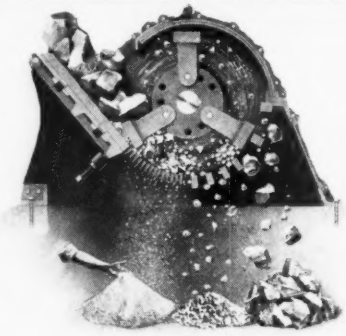
And— in spite of the record breaking sales of ERIES — by working the big ERIE plant night and day shifts, we are still able to make prompt deliveries.

ERIE STEAM SHOVEL CO., Erie, Pa., U. S. A.

ERIE Revolving Shovels

Builders of ERIE Shovels, Cranes, etc.
Branch Offices: Boston, New York. Philadelphia, Pittsburgh, Atlanta, Chicago. Representatives throughout the U. S. A.

NOTE: Believing statements from users to be tne best evidence of merit, we list below letters from users to substantiate the claims made for Williams hammer crushers. Space permits showing only a few letters. A description of your operations, however, will bring complete details showing how Williams crushers have been economically applied to similar work.



To Prove Our Claims for Williams Hammer Crushers

1. ***50% Less Investment.***

"By eliminating secondary crushers, conveyors, elevators, etc., Williams crusher has saved us $20,000.00 in first cost." John Herzog & Son, Forest, Ohio.

2. ***Reduces Large Stone to Required Size in One Reduction.***

"Takes any size rock handled by 2½ yard steam shovel—reduces to ¾ inch." San Antonio Pt. Cement Co., San Antonio, Tex.

3. ***Lower Crushing Costs.***

"Replaced two gyratories with a No. 4 Williams hammer crusher. Reduced cost 35 per cent to 40 per cent." Jacksboro Crushed Stone Co., Jacksboro, Tex.

4. ***Makes Macadam with No More Fines (Usually Less) Than Jaw or Gyratory Crushers.***

"Makes best prepared stone State Highway Commission has used." Indiana State Farm, Greencastle, Ind.

"Crushing 24inch rock to 1½. Ballast from Williams as good or better than former jaw crushers." E. P. Jones, Florence, Kans.

WILLIAMS PATENT CRUSHER & PULV. CO.
802 St. Louis Ave. St. Louis, Mo.

Chicago
37 W. Van Buren St.

New York
15 Park Row

San Francisco
415 5th Street

Williams

PATENT CRUSHERS GRINDERS·SHREDDERS

KOEHRING

Crane Excavator

66% Greater Clutch Frictional Area!

THAT'S why the Koehring has *Finger-tip control* at the levers!

Levers work easy because the 66% greater contact surfaces of the double outside band, equalizing friction *clutch* makes the levers work easy!

So, you have Finger-tip control without mechanical complications to help shift levers which ought not to be hard shifting in the first place. The Koehring operator does not lose the *"feel"* of the bucket —an important factor in accuracy of operation!

Crane Capacities

No. 1—10 tons at 12 ft. radius. Clamshell buckets loaded with sand or gravel: 1 cu. yd. bucket weighing 3450 lbs. at 28 ft. radius, ¾ cu. yd. bucket weighing 2600 lbs. at 34 ft. radius. Boom lengths to suit conditions. 4 cylinder, 5" x 6" gasoline engine, 1000 R.P.M.

No. 2—15 tons at 12 ft. radius. Clamshell buckets loaded with sand or gravel: 1¼ cu. yd. bucket weighing 3850 lbs. at 32 ft. radius. 1 cu. yd. bucket weighing 3450 lbs. at 36 ft. radius. ¾ cu. yd. bucket weighing 2600 lbs. at 43 ft. radius. Boom lengths to suit conditions. 4 cylinder, 5¾" x 7" engine, 1000 R.P.M.

KOEHRING HEAVY DUTY

Write for Crane Excavator Bulletin No. Cr.32.

KOEHRING COMPANY

PAVERS, MIXERS—GASOLINE CRANES, DRAGLINES AND SHOVELS

MILWAUKEE, WISCONSIN

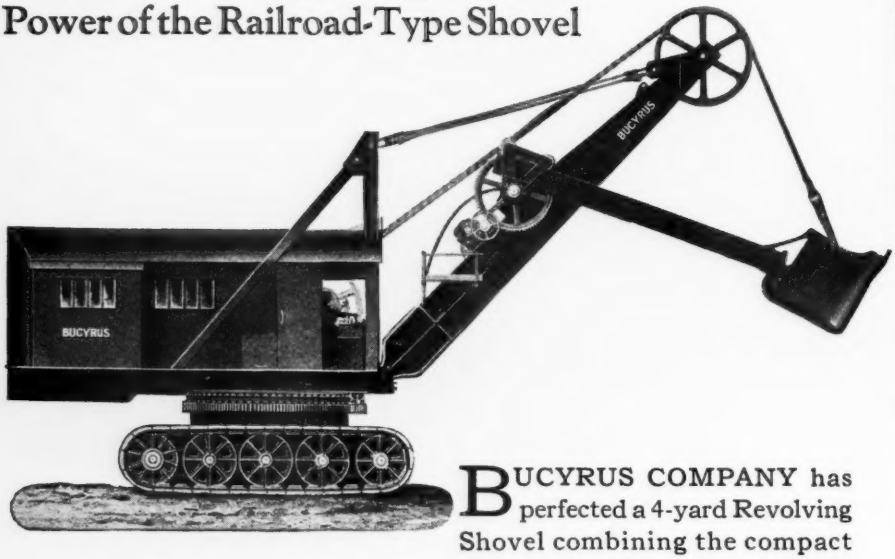
Sales Offices and Service Warehouses in principal cities

Foreign Dept., Room 1370, 50 Church St., N. Y.
Canada, Koehring Company of Canada, Ltd., 105 Front St., East, Toronto, Ontario.
Mexico, F. S. Lapum, Cinco de Mayo 21, Mexico, D. F.

A2688

A New 4-yard Heavy-Duty Revolving Shovel

—with the Strength, Rigidity and Power of the Railroad-Type Shovel



BUCYRUS COMPANY has perfected a 4-yard Revolving Shovel combining the compact strength and power of the railroad-type shovel, with the full-circle swing and mobility of the revolving shovel. This new machine is built to handle the toughest digging encountered in mine, quarry and heavy construction work.

Steam or Electric

We will be glad to send you
Descriptive Bulletin
D-1201-A

BUCYRUS

Established in 1880.

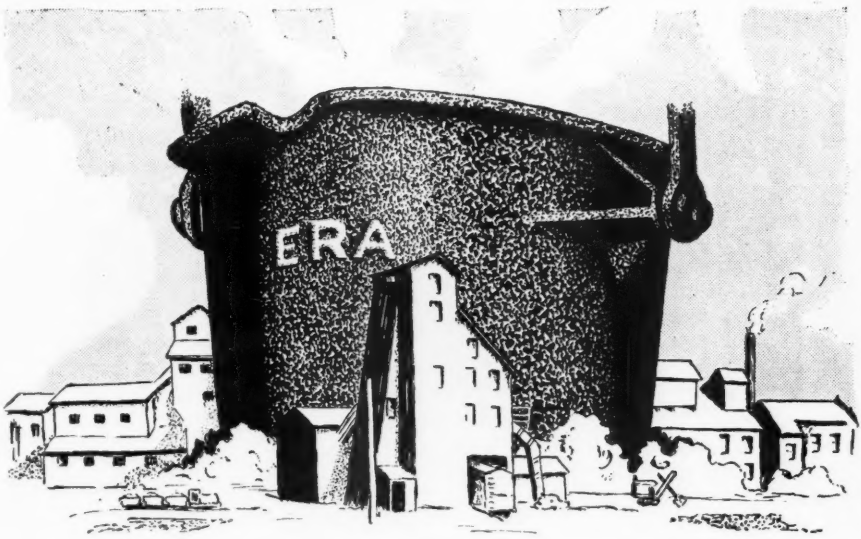
Railroad Type and Revolving Shovels of All Sizes, Dragline Excavators, Trench Excavators, Dipper, Hydraulic and Placer Dredges, Spreader Plows, Wrecking Cranes, Etc.

BUCYRUS COMPANY, South Milwaukee, Wis.

New York Chicago Birmingham San Francisco Portland Denver Tokyo London

A Special Plant at Evansville, Indiana, Devoted Exclusively to Small Revolving Shovels.

682



Save Repair Dollars

Use "ERA" Manganese Steel Parts

THE WAY to save repair dollars and avoid delays is to make your replacements with "ERA" Manganese Steel Castings — because they give long, long service and stand up under abrasive wear as no other type of steel can.

"ERA" Manganese Steel is the choice of the wise operator because its greater durability permits greater economy, in the long run, than cheaper steel — to say nothing of the satisfaction of knowing that mid-season breakdowns are no longer a menace.

Are you making replacements with "ERA" Manganese Steel? If not, **now** is the time to get the facts. Write for catalogue.

HADFIELD-PENFIELD STEEL CO.

Bucyrus, Ohio

MANGANESE STEEL

ERA

THE FIRST - STILL LEADS IN QUALITY

Guarantee

Owen Buckets, properly installed and operated, are guaranteed to do a bigger day's work than any other bucket of the same weight and capacity—

—or—

Write your own guarantee!

THE OWEN BUCKET CO.

A Mouthful at Every Bite

BELOW the snow-capped peaks of India's Himalayas, the flesh-eating leopard roams freely in search of prey. The native fear of this ferocious "beast of shadows" is based on the gruesome knowledge of steely jaws that—like an Owen Bucket—snap a mouthful at every bite.

For Owen Buckets boast the distinction of getting a chuck-full load every time the closing line is overhauled. And the more loads a day—the more time and money you save. Owen Buckets possess nine different advantages that together contribute to a superior construction in bucket design which insures the greatest value to your digging dollars.

The Story of Owen Buckets—just what they will do for you—is told, and illustrated, in a folder which we call "2-A." A copy is yours for the asking.

Here is a ¾-yard type "D" Owen Bucket getting a full grab of clay every time it rises from the sewer trench. This bucket is one of three which are used for excavation work by the owners—The Haddad-Mall Company of Cleveland.

THE OWEN BUCKET COMPANY

706 ROCKEFELLER BUILDING CLEVELAND, OHIO

New York, Pittsburgh, Philadelphia, Baltimore, Chicago, St. Louis, Miami, Los Angeles, Dallas, Portland, Minneapolis, San Francisco.

OWEN CLAMSHELL BUCKETS INSURE A BIGGER DAY'S WORK

Owen Buckets

INSURE A BIGGER DAY'S WORK

© OBCO

Du Pont chemical engineers insure uniformity of quality by chemical control through every step of manufacture from raw material to finished product.

Uniformity of production is a safety factor in the use of explosives

YOU can assure yourself and also your employees of greater safety by the use of du Pont explosives.

In the manufacture of explosives, the du Pont Company employs the most exacting methods to obtain a uniform production. As a result, its explosives accomplish complete detonation, cause an increase in production and eliminate the dangers attending a partial detonation. Specifying du Pont explosives is another way to apply safety methods to hazardous operations.

The du Pont "oval" signifies uniformity, dependability and stability of explosives,—a combination of qualities which are safety factors in blasting operations.

In quarrying operations use du Pont Explosives

There is a du Pont explosive to meet every blasting need—to do *your* particular work *best* at *least* expense.

Du Pont Blasting Accessories give you maximum efficiency from your explosives. Make every shot *sure*—protect your blasting investment by using only du Pont accessories.

For further information about du Pont explosives and blasting accessories, please refer to MINING CATALOG — METAL QUARRY EDITION and PIT and QUARRY HAND BOOK — or write to nearest office.

E. I. DU PONT DE NEMOURS & CO., Inc.

Explosives Department

WILMINGTON, DELAWARE

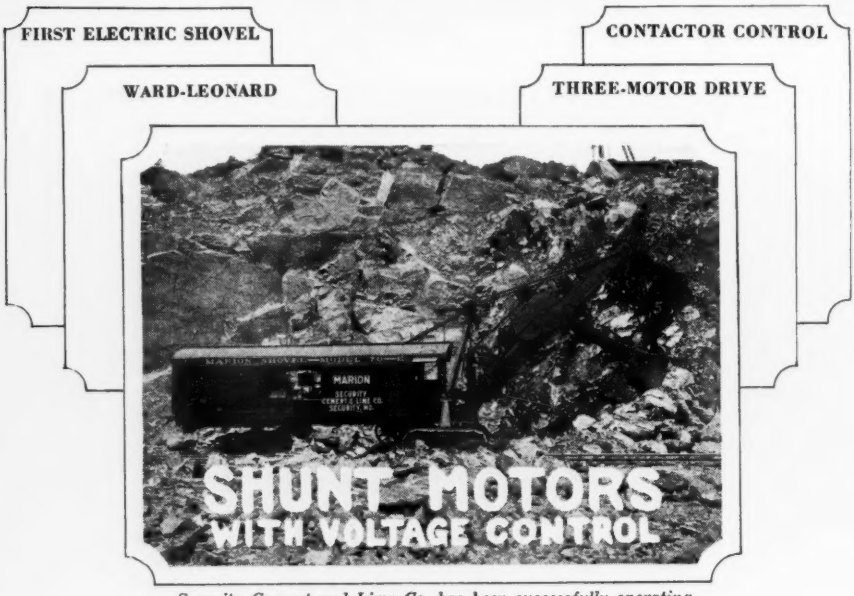
DU PONT

Branch Offices:

Birmingham ....Ala.
Boston .....Mass.
Buffalo ..... N. Y.
Chicago ..... Ill.
Denver ..... Colo.
Duluth ..... Minn.
El Paso ..... Tex.
Huntington, W. Va.
Joplin ..... Mo.
Kansas City....Mo.
Mexico City....Mex.
Miami ..... Fla.
New York ....N. Y.
Pittsburgh .... Pa.
Portland ..... Ore.
St. Louis..... Mo.
San Francisco, Cal.
Scranton ..... Pa.
Seattle ..... Wash.
Spokane .... Wash.
Springfield .....Ill.

Du Pont Products Exhibit
Atlantic City, N. J.

POWDER MAKERS SINCE 1802



Security Cement and Lime Co. has been successfully operating with Shunt Wound Motors for over a year and a half

FIRST AGAIN!

Almost two years ago MARION gave to Electric Shovels a decided improvement and advantage through shunt wound motors.

The ability to "plug" or reverse under load gives intense satisfaction to both operator and owner. This new idea and practice eliminates complicated electrical apparatus and speeds up shovel operation.

Marion continues to lead in shovel development after enjoying that position for over forty years.

Variable-Voltage control, as designed into Marions, approximates the flexibility and simplicity of Marion steam shovels—an ideal condition when you consider the lower operating costs of Marion electric shovels.

THE MARION STEAM SHOVEL COMPANY MARION, OHIO, U.S.A.

MARION

It's Easy to Select Your Bucket Elevator from This Book

IT summarizes the experience of nearly half a century in dealing with thousands of elevator problems.

From the carefully compiled data, typical layouts and tables of specifications included in this new catalog you can readily choose an elevator to meet your particular requirements.

Standardization of Jeffrey Bucket Elevators eliminates the expense of layouts and drawings, and makes quick delivery possible.

A copy of this new catalog No. 410-A will be mailed on your request.

The Jeffrey Mfg. Co. 917-99 North Fourth Street **Columbus, Ohio.**

New York, Buffalo, Rochester, N. Y., Philadelphia, Pittsburgh, Scranton, Pa., Boston, Cincinnati, Cleveland, Charleston, W. Va., Chicago, Detroit, Milwaukee, St. Louis, Denver, Salt Lake City, Los Angeles, Birmingham, Charlotte, N. C., Montreal

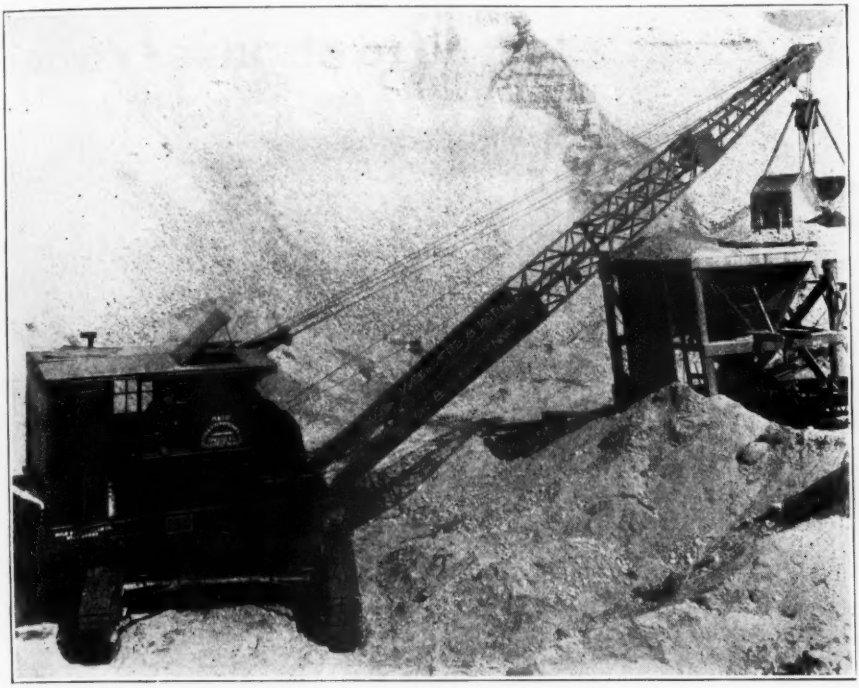
JEFFREY
MATERIAL HANDLING EQUIPMENT

Clamshell Crane; Full Circle Steam Shovel—on Continuous Chain Treads

The "AMERICAN" Ten Ton Crane on Continuous Chain Treads is a fast worker and goes anywhere independently of tracks. One of these machines with a long boom for clamshell work and a steamshovel boom with crowding engine and dipper is the equivalent of several machines: A fast accurate clamshell crane, a rugged full-circle shovel which gets along practically without pit men, and a general purpose crane for handling heavy loads with hook, sling or skip.

The Continuous Chain Tread mechanism is heavier and stronger than the usual run of such devices. That means continuous service without tie-ups for repairs. This is no idle boast; among the more notable examples of conclusive proof are the Lock Joint Pipe Company's jobs at Verdigris, Okla. and at Denver, Colo.

AMERICAN
HOIST & DERRICK CO.
Saint Paul, Minn.
New York, Chicago, Pittsburgh, Seattle, New Orleans



Here's a Type "E" for the Gravel Pit

The O-S Type "E" Crane with 40 foot boom and 1 cubic yard O-S Clamshell Bucket is the machine that keeps the washing plant busy.

In the above illustration a Type "E" Crane is shown in the gravel pit of the Peterson Sand and Gravel Co. of Janesville, Wis. The Crane is used to fill the hopper and the material is carried into the washing plant on a belt conveyor. In this way the maximum yardage is assured because there is no time lost in the transferring of material.

There is an Orton Crane built to suit your requirements. The smallest handling a ½ yard bucket on a 24′ boom; the largest handling a 2 yard bucket on a 70′ boom. (These Cranes are of the Flexible Tread Type).

Drop a line today for a catalog and more information about O-S Cranes and Buckets.

Have you a copy of our New General Catalog No. 37
Write for one

ORTON & STEINBRENNER CO.

Locomotive Cranes, Flexible Tread Cranes, Gantry Cranes, Truck Cranes.

608 So. Dearborn Street
CHICAGO, ILL.

Clamshell Buckets, Orange Peel Buckets, Rock Crushers, Power Shovels.

A complete line to choose from 10-tons to 40-tons capacity

McMyler-Interstate cranes are built in sizes of from 10-tons to 40-tons capacity. There is one to fit your requirements. No. 2 and No. 4, the 10-ton and 20-ton models are shown here. Complete details on any model will be sent on request and our engineers will gladly make recommendations for your particular job.

Locomotive Cranes • Pile Drivers • Car Dumpers • Clam-shell Buckets • Derrick Cars

ME-14

McMyler-Interstate

NEW YORK BUFFALO PHILADELPHIA PITTSBURGH CLEVELAND DETROIT CHICAGO SAN FRANCISCO LOS ANGELES

Not just a shovel —a mighty good shovel

And the modern Massillon will prove to be a mighty good shovel under any conditions that you may use it.

Giant digging power combined with speed and mobility makes the modern Massillon the type of shovel that aggregates the biggest production with lowest maintenance cost. The modern Massillon offers further economy through interchangeable repairs, accessibility, endurance and dependability.

The modern Massillon can be used with clamshell or dragline equipment, or as a locomotive crane. Send for our descriptive book.

Built By

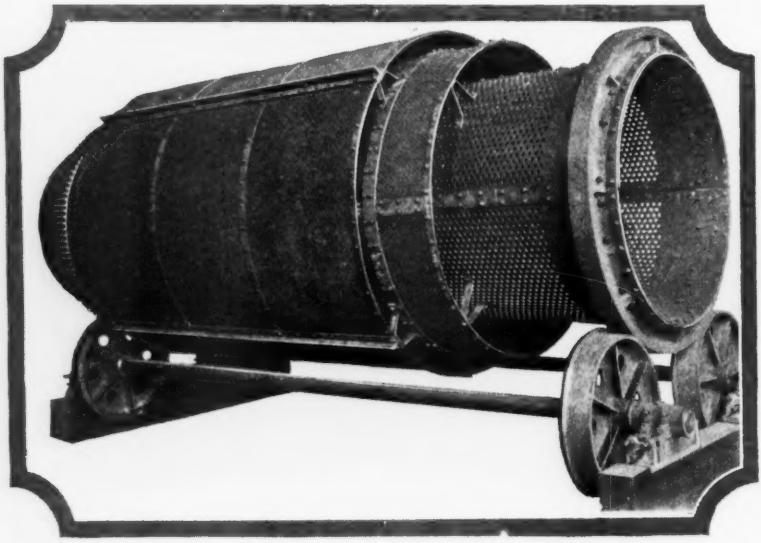
THE RUSSELL & CO.

MASSILLON, O.

(Established 1842)

The **MODERN MASSILLON**

Steam — 3/4 – 7/8 RANGE — Shovel



Webster Revolving Screens

FOR EFFICIENT screening in Sand, Gravel and Stone Crushing Plants, Webster Revolving Screens are reliable and dependable in operation. They are accurately designed and ruggedly built for years of hard service—that means lasting satisfaction.

Built in various types and sizes with capacities to suit the individual installation.

Let our engineers help you in the selection of proper screens for your plant. They are at your service.

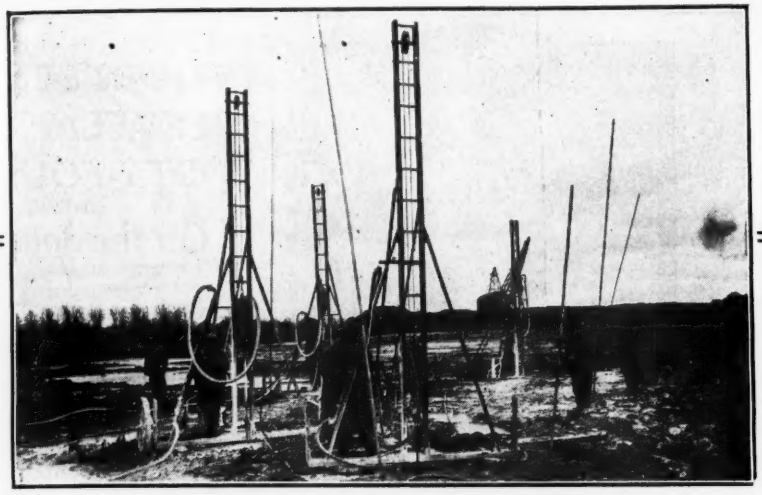
Webster equipment for sand, gravel, cement and stone crushing plants includes belt conveyors, bucket elevators, screens, screw conveyors, chain, sprockets, buckets, etc.

Catalog sent on request.

THE WEBSTER MFG. COMPANY

4500-4560 Cortland Street

CHICAGO



Four Model 21 Turbros on Derrick Rigs

Drilling Primary Holes with Waugh Drills

THE illustration shows one application of the hammer drill to quarrying operations. In this instance, four Model 21 Waugh Turbros are being used, mounted on derricks, for drilling holes 30 feet deep finishing at 2 inches diameter.

The portability of the derrick facilitates quick set-ups and steel changes, and greatly increases the daily overall footage.

For deep holes of larger diameter, the Model 34 Waugh Turbro is rec. mmended. Using the Model 34, one property is securing a daily footage of 200 feet, holes 40 feet deep, finishing at 3 inches.

THE DENVER ROCK DRILL MANUFACTURING COMPANY

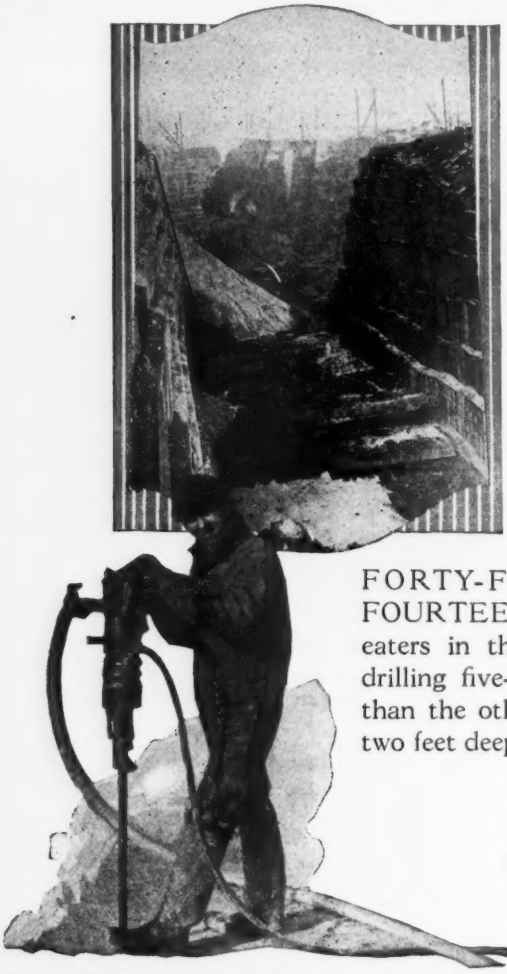
DENVER COLORADO

Rock Drills, Drill Steel Sharpeners and Hole Punchers, Portable Hoists

San Francisco, Seattle, Spokane, El Paso, St. Louis, Duluth, Joplin, Walker, Salt Lake City, Pittsburgh, Knoxville, Birmingham, Butte, New York, Houghton, Pottsville, Mexico City, Lima, Santiago

ROCK WAUGH DRILLS

Canadian Rock Drill Company, Limited, Sole Agents in Canada
Montreal Quebec Cobalt Ont. Nelson, B.C. Vancouver, B.C.
The Denver Rock Drill & Machinery Company, Limited
Sole Agents in South Africa and Rhodesia
Southern Life Building, Johannesburgh, Transvaal, S. Africa
Andrews & George Company, Sole Agents in Japan, Tokio, Japan
Allied Engineering, Limited, Melbourne, Australia



FOURTEEN CLEVELAND FORTY-FOURS

On the Job Now!

They had been worrying along with ordinary rock-drilling machines, going two or three feet deep with holes. Then they tried a CLEVELAND FORTY-FOUR! Now there are FOURTEEN of these good rock-eaters in the quarry, and they are drilling five-foot holes in less time than the other drills required to go two feet deep!

Ask us for Bulletin 49

The Cleveland Rock Drill Co.

3734 East 78th Street, CLEVELAND, OHIO

CHICAGO, ILL. 605 S. Dearborn St.
NEW YORK CITY 30 Church St.
NEGAUNEE, MICH. 222 Heath St.
DETROIT, MICH. 428 Insurance Exchange Bldg.
ST. LOUIS, MO. 2091 Railway Exchange Bldg.
PHILADELPHIA, PA. The Bourse Bldg.
BIRMINGHAM, ALA. 403 N. 24th St. Box 2028
BOSTON, MASS. 113 Pearl St.
PITTSBURGH, PA. 922 Farmers Bank Bldg.

Canadian Trade Supplied by The Cleveland Pneumatic Tool Co. of Canada, Ltd., Toronto, Ontario
British Representatives, John McDonald & Co., Polloksbaws, Glasgow, Scotland.

CLEVELAND ROCK DRILLS

Telsmith Assures You More Gravel—Better Gravel—Cheaper Gravel

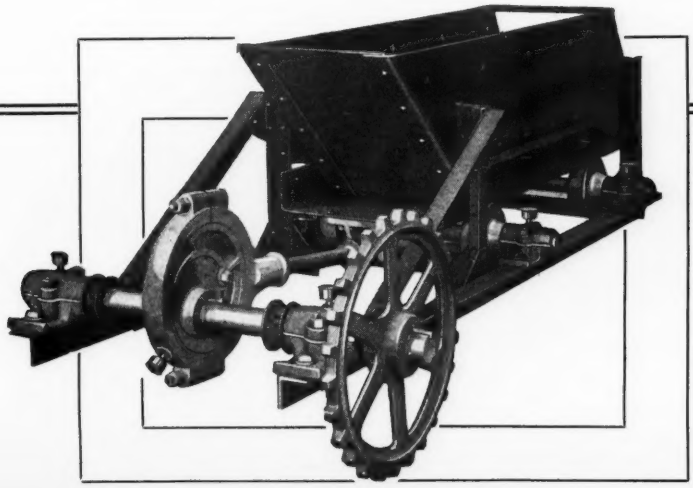
YOUR conveyors—are they alternately overloaded and empty? Your screens—are they flooded one minute and idle the next? If so, just remember that machinery, like humanity, suffers from irregular feeding. A steady flow of aggregate through your plant will insure greater daily capacity, better graded material and a lower cost per yard.

Take a look at the Telsmith Plate Feeder—an inexpensive but complete self-contained unit that will deliver gravel or stone at any rate desired. It's just a pan, actuated by a cam, with an adjustable eccentric to change the rate of feed. You can run this device for five years without noticing either the up-keep or power consumption. It's the cheapest, yet most valuable equipment in a quarry or gravel plant—something that the up-to-date operator can't afford to go without. Glad to send you bulletin FR-15.

SMITH ENGINEERING WORKS

3183 Locust Street, Milwaukee, Wis., U. S. A.

Old Colony Bldg., Chicago, Ill.
18 East 41st St., New York City.
Waldo Bros. & Bond Co., Boston, Mass.
Seibert-Milburn Co., Columbus, Ohio
Beckwith Mchy. Co., Pittsburgh and Cleveland

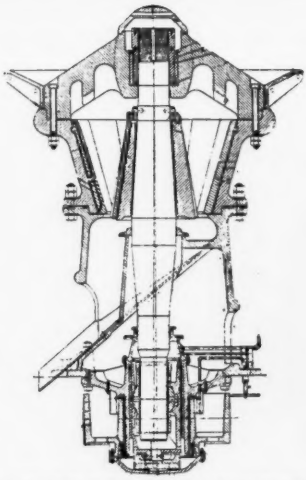


THE CRUSHERS

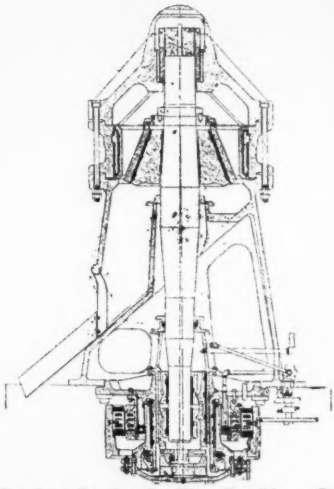
with the Troubles Left Out

WHY THEY LEAD

1—They are noiseless and run like watches.
2—50% greater capacity for same power.
3—Practically no wear on anything but head and concaves.
4—Short shaft and saving in head room with packed dust collars.
5—Shaft reinforced with self-locking head so that it cannot break where 90% of shafts have broken.
6—Can be driven right, left, or standard, as sent from shop.
7—Eccentric is turned by flexible coupling attached to pulley, which prevents side thrust and heating, as in geared crushers.
8—Ball and socket eccentric, self-aligning, eliminating friction and heating. Runs for years without attention.
9—Positive circulating oil system through filter and cut geared oil pump.
10—Made in our own shop by experts, trained for the job.
11—It is a crusher with the trouble left out. See it in operation, and you are unfit to listen to any geared crusher salesman. In fact, if you are near one of his machines, you can't hear him, if you are so inclined.
12—Our fine crusher does the work of 4 geared crushers.



Standard Ball Bearing Gearless Crusher. Sizes No. 1 to No. 60—Weights 1,000 to 900,000 lbs.



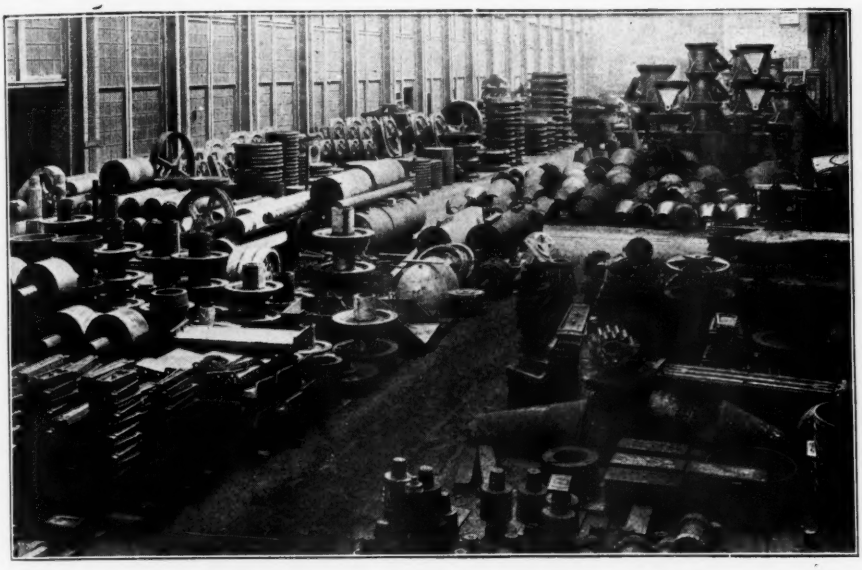
Gearless Crusher for Fine Crushing. Do not be deceived by Vertical Concaves; that is not what makes a fine crusher.

Send for catalogue and tell us what your problems are, and one of our experts will call on you without obligation on your part.

KENNEDY VAN SAUN MFG. & ENGR. CORP.

50 Church St. **NEW YORK**

Kearns Bldg., Salt Lake City, Utah
414 So. Spring St., Los Angeles, Calif.
Annex Hotel, St. Louis, Mo.
1739 Roanoke Bldg., Chicago, Ill.
73 Cullinan Bldg., Johannesburg, So. Africa
40, Rue des Mathurins, Paris, France

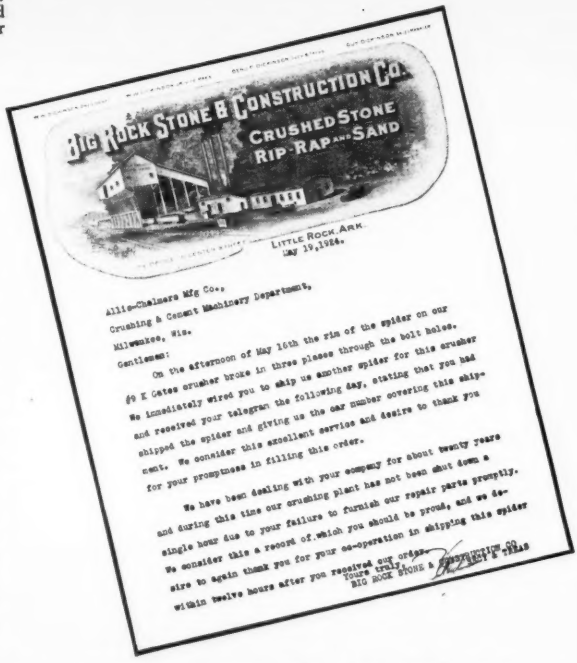


A portion of our stock of crusher parts carried on hand for the convenience of our customers.

Service

Here's What It Means

On Saturday morning, May 17, 1924, we received telegram sent from Little Rock, Arkansas, on May 16th to ship one spider for No. 9 K Gates crusher and although this spider weighs approximately 20,500 lbs., it was in stock finished ready for shipment. We were able to wire our customer that shipment was going forward same day even though our plant closes down at noon on Saturday.



BIG ROCK STONE & CONSTRUCTION Co.
CRUSHED STONE
RIP-RAP AND SAND

LITTLE ROCK, ARK.
May 19,1924.

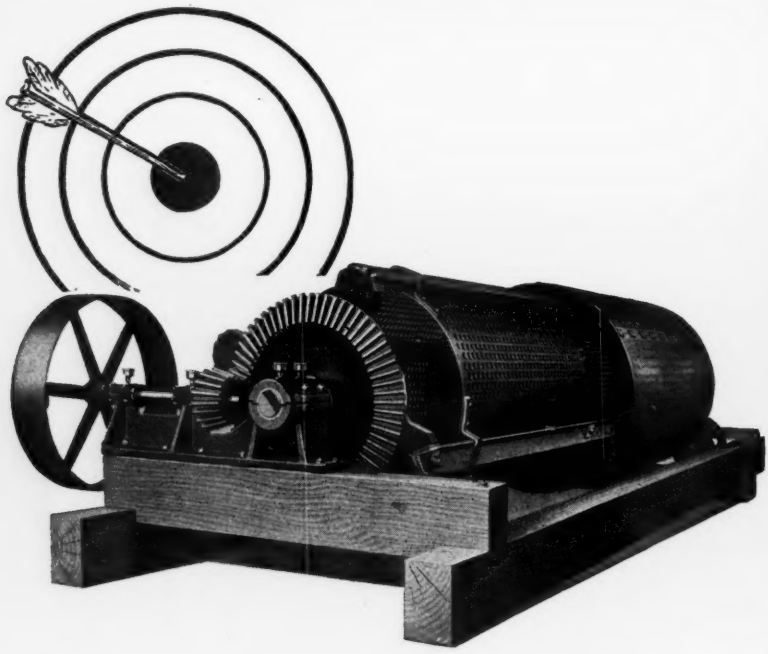
Allis-Chalmers Mfg Co.,
Crushing & Cement Machinery Department,
Milwaukee, Wis.
Gentlemen:

On the afternoon of May 16th the rim of the spider on our #9 K Gates crusher broke in three places through the bolt holes. We immediately wired you to ship us another spider for this crusher and received your telegram the following day, stating that you had shipped the spider and giving us the car number covering this shipment. We consider this excellent service and desire to thank you for your promptness in filling this order.

We have been dealing with your company for about twenty years and during this time our crushing plant has not been shut down a single hour due to your failure to furnish our repair parts promptly. We consider this a record of which you should be proud, and we desire to again thank you for your co-operation in shipping this spider within twelve hours after you received our order.

Yours truly,
BIG ROCK STONE & CONSTRUCTION CO.

ALLIS-CHALMERS
MILWAUKEE, WIS. U.S.A.



Our aim for Toepfer Screens

TOEPFER Screens are built especially to meet the needs of screening in pit or quarry, and that our aim to meet these needs has been successful is evidenced by the many highly satisfactory installations of Toepfer Screens.

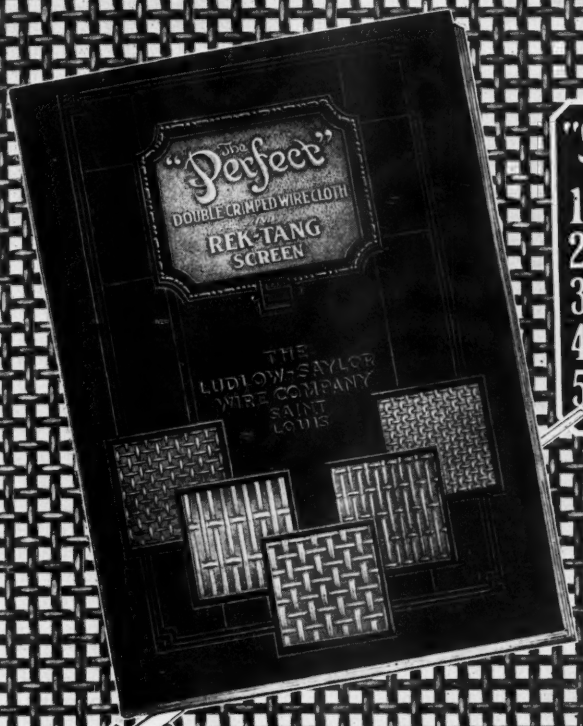
Toepfer combination screens produce well washed and sized material at a lower cost in power and water than any other type of scrubber. Steel angles run longitudinally with the scrubber section, which raise and drop the material and water continually, insuring a high grade product. The best of materials are used, and rigidity and perfect alignment are secured.

The Toepfer combination screen and scrubber will deliver as many sizes as our regular screen without additional space being required. A card request will bring you our catalog. Send for it today.

W. TOEPFER & SONS CO.
Broadway and Menominee St.,
MILWAUKEE, WIS.

TOEPFER

REVOLVING SCREENS



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1 Most COMPLETE wire cloth SERVICE
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LUDLOW - SAYLOR WIRE CLOTH, properly selected and applied to your equipment, will **screen more feed, take out more fines,** and **raise the average effectiveness of every subsequent process.**

Our new Catalogue No. 47-E4 is a Text-Book on Screens.

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says one operator in commenting on the value of Pit and Quarry HAND BOOK.

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HAND BOOK

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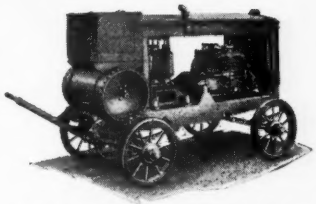
WHEREVER the nature of the work calls for mobile air-power—there is a CP Portable Compressor in sizes of 100 to 300 cu. ft. to meet requirements. These dependable compressors are built in gasoline or electric motor driven types mounted upon steel or rubber-tired wheels, CP Trailers, motor trucks or skids.

All sizes of portable compressors are directly connected to the engine or motor —no gears or belts are used. With such features as Simplate Valves, automatic regulation and self-lubrication—CP Compressors insure the greatest attainable efficiency.

For valuable reference and for complete information—write for bulletins.



CP Portable Gasoline Engine Driven Compressor — mounted upon rubber-tired trailer.

Chicago Universal Hose Coupling—the most convenient coupling made. Neither half is male or female at the connection end but a combination of both. Constructed of tough bronze.

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BOYER PNEUMATIC HAMMERS··LITTLE GIANT PNEUMATIC AND ELECTRIC TOOLS
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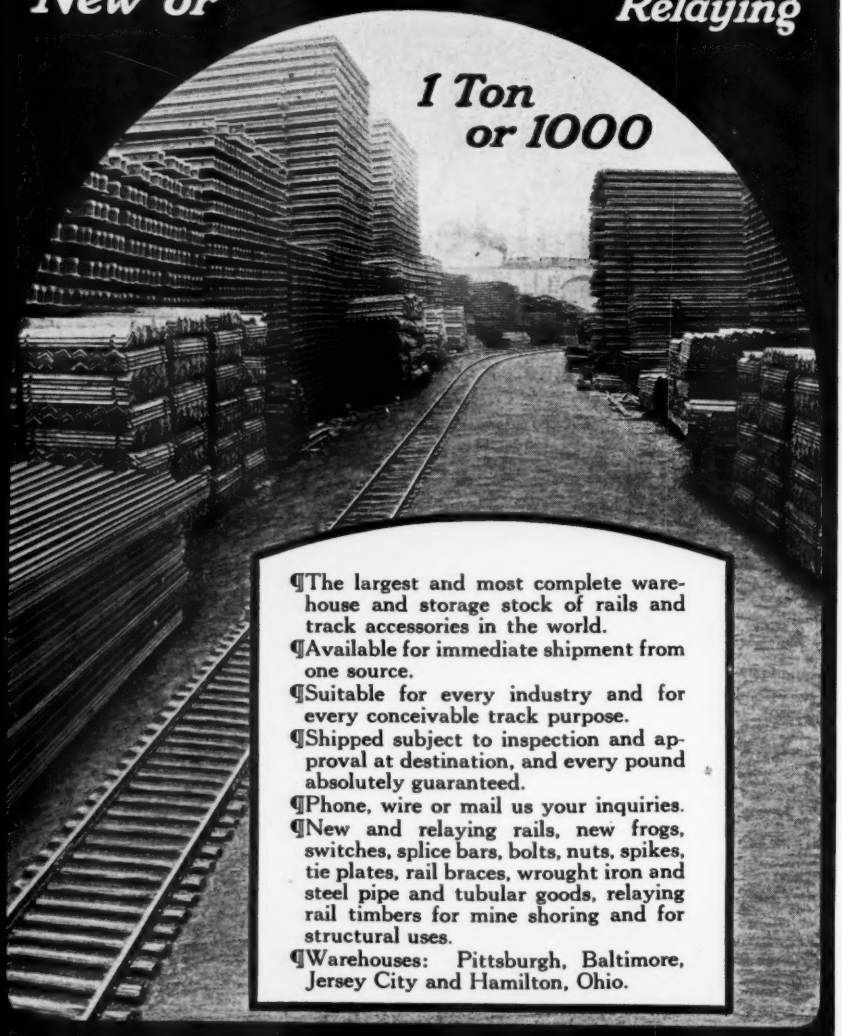
Depend upon *that name*

RAILS

New or *Relaying*

1 Ton or 1000



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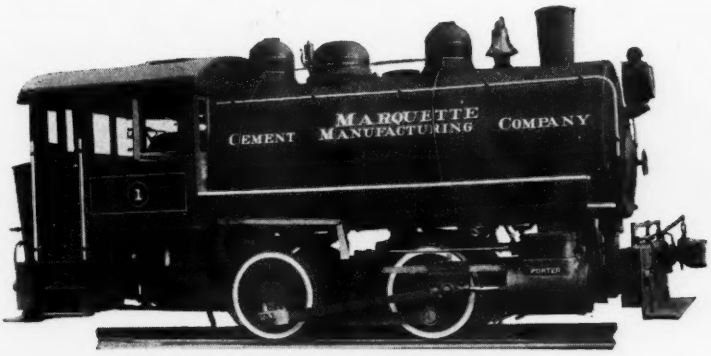

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Acme Cement Corp.	2	Louisville Cement Co.	10
Alpha Portland Cement Corp.	2	Marquette Cement Mfg. Co.	1
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Bessemer Limestone & Cement Co.	18	Michigan Portland Cement Co.	1
Buffalo Cement Co., Ltd.	3	Missouri Portland Cement Co.	1
Castalia Portland Cement Co.	3	Monarch Cement Co.	1
Clinchfield Portland Cement Co.	3	Nebraska Cement Co.	1
Continental Portland Cement Co.	2	Oregon Portland Cement Co.	1
Coplay Cement Manufacturing Co.	4	Pacific Portland Cement Co.	4
Crescent Portland Cement Co.	5	Peerless Portland Cement Co.	1
Dixie Portland Cement Co.	5	Pennsylvania Cement Co.	1
Great Western Portland Cement Co.	1	Riverside Portland Cement Co.	1
Helderberg Cement Co.	2	Santa Cruz Portland Cement Co.	2
Hudson Valley Portland Cement Co.	1	South Dakota State Cement Co.	2
International Cement Corp.	1	Southwestern Portland Cement Co.	1
Iroquois Portland Cement Co.	1	Southern States Portland Cement Co.	2
Kansas Portland Cement Co.	2	Tidewater Portland Cement Co.	2
Kirkfield Portland Cement Co.	1	Union Cement & Lime Co.	4
Knickerbocker Portland Cement Co.	1	Virginia Portland Cement Co.	3
LaSalle Portland Cement Co.	1	Wayland Portland Cement Co.	1
Lehigh Portland Cement Co.	14	Western States Portland Cement Co.	2

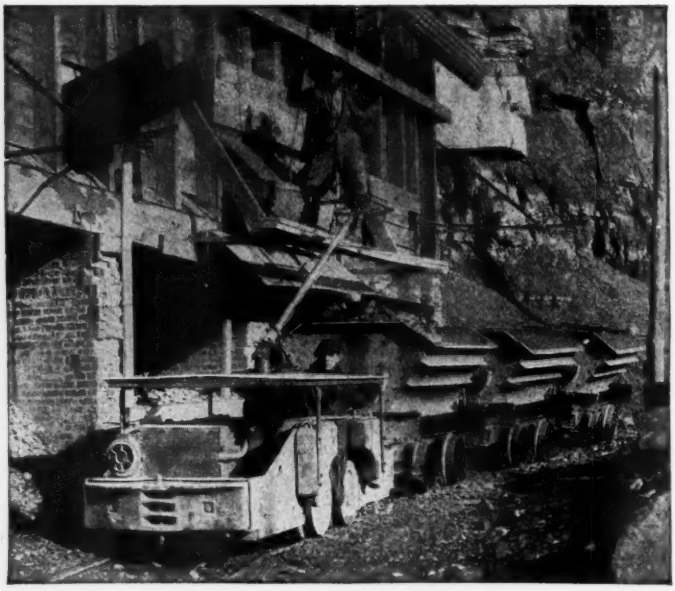
For data—our catalog. For expert advice—our Engineering Department.

H. K. PORTER COMPANY

Established 1865

PITTSBURGH, PENNA.

PORTER
"better built"
locomotives



Dependable—

ZERO WEATHER means nothing in the operation of an electric locomotive, which is just as dependable and just as ready-every-minute in winter as in summer.

It seldom needs repairs. The record at a quarry in Illinois is that not a cent was spent for repairs in three years.

An electric locomotive does its work cheerfully all day—and all night too, if necessary—no matter what the job or the kind of weather. And it's still young when it's ten years old.

Those who have them say the electric locomotives are the most dependable items of their plant equipment.

(85)

GOODMAN MANUFACTURING COMPANY

4140 to 4834 South Halsted Street

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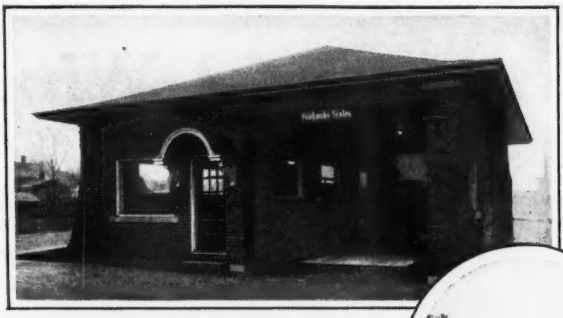

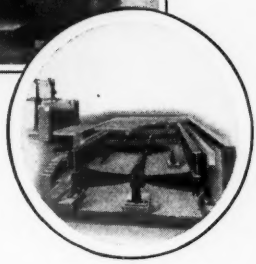

Note the heavy track scale construction

HEAVY auto truck weighing

is not a "wagon scale" job

Each year brings more auto trucks; heavier auto trucks. And the problem of weighing them keeps pace. Auto truck loads are not only greater, but heavily concentrated on the rear wheels of the truck, making the shock on the scale doubly severe. It is a new problem—a problem that cannot be solved by a "wagon scale."

But the coming of the auto truck did not present a new problem to Fairbanks. For years Fairbanks Scales have been built for weighing railway cars and enormous hoppers of grain in elevators—harder service than is ever encountered in weighing auto trucks.

It was simply necessary to incorporate the railway track scale principle in the Fairbanks Auto Truck Scale—and the resulting ruggedness, a new degree of ruggedness for scales of this type, is clearly shown in the illustration of lever construction above.

Hundreds of quarrymen are measuring rock products by weight. It has been conclusively proved a more accurate—more satisfactory method. Within a very short time—if not now—you must face the problem of installing a heavy scale. And it is simply good business to install a scale that will meet the hardest possible service for a lifetime.

One of our representatives will show you why the heavy weighing of today demands this super-scale. The coupon will bring your copy of the informative booklet, "A Talk on Scales."

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900 S. Wabash Ave., Chicago.
Please send your booklet, "A Talk on Scales," also Type "S" specifications to

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Address

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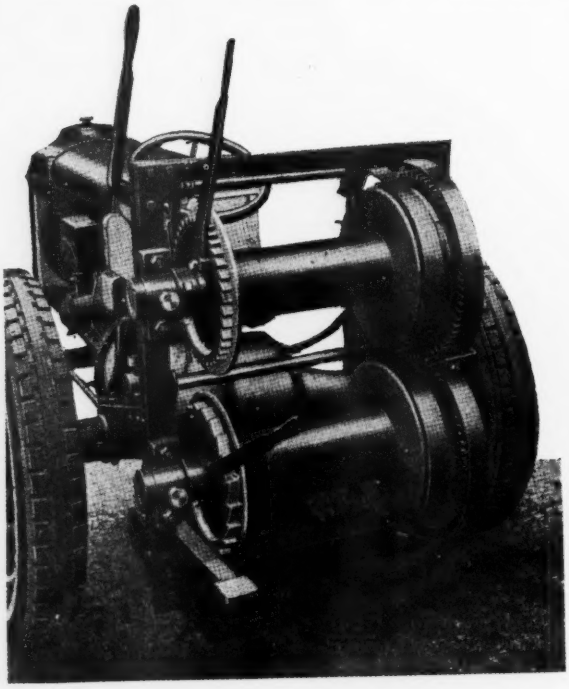
Continental Winches



Sturdy Dependable Hoisting Units

FOR either portable or stationary hoisting work a Continental Winch is ideal. Either the friction or geared type, made with single or double drum, will prove its merit.

The friction type is used extensively for loading logs, heavy timbers, and any other heavy objects that require careful handling or speedy operation. It is especially adapted for dragline scrapers, and when mounted on the Fordson Tractor, it makes a most complete and economical unit.

The powerful brakes which control the drums are operated with convenient foot levers, excepting the top drum on the double drum type, which is operated by hand. Each drum is equipped with ratchet and pawl, so that the load may be held in suspension without using the brake. Speed ranges from 60 to 200 ft. per minute on all lines.

Every Continental Winch is unconditionally guaranteed against defective workmanship and materials. Defective parts replaced F.O.B. Memphis without charge.

SPINKS SUPPLY CO.

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Free Service to our readers

For the convenience of readers who are in the market for equipment, our "Free Service" department will furnish on request any information, catalogs and prices on any machinery, equipment or supplies used in pits and quarries. The coupon below makes it easy for you. Simply check, sign and mail.

Pit & Quarry, Rand McNally Bldg., Chicago, Ill.

Pit and Quarry, Research Department,
Rand McNally Bldg., Chicago, Ill.

WE ARE IN THE MARKET for the items checked below, and would be glad to receive catalogs, prices or other information.

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- ☐ Air Compressors, Portable
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- ☐ Baffles
- ☐ Bag Filling Machines
- ☐ Bag Sewing Mach.
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- ☐ Bags, Paper
- ☐ Barges
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- ☐ Belting, Transmission
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- ☐ Bins, Clay Tile Storage
- ☐ Bins, Concrete Storage
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- ☐ Block Machinery, Concrete
- ☐ Boiler Compound
- ☐ Boiler Skimmers
- ☐ Boilers
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- ☐ Magnetic Separators
- ☐ Manganese Steel
- ☐ Manganese Steel Parts
- ☐ Metal, Babbitt
- ☐ Metal, Perforated
- ☐ Meters
- ☐ Mills, Chaser
- ☐ Mills, Tube
- ☐ Mixers, Concrete
- ☐ Mixers, Plaster
- ☐ Motors, Electric (H. P.....)
- ☐ Motors, Gasoline (H. P.....)
- ☐ Motor Truck Dump Bodies
- ☐ Motor Trucks
- ☐ Nozzles, Hydraulic Mining
- ☐ Nozzles, Suction Screen
- ☐ Oil Burners
- ☐ Oils and Lubricants
- ☐ Perforated Metal
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- ☐ Pipe, Hydraulic
- ☐ Pipe, Iron
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- ☐ Pulverizers, Hammer
- ☐ Pulverizers, Ring
- ☐ Pulverizers, Roll
- ☐ Pump Repairs
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- ☐ Pumps, Dredging
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- ☐ Pumps, Water Supply
- ☐ Pyrometers
- ☐ Rail, Steel
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- ☐ Rope, Wire
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- ☐ Scales, Track
- ☐ Scrapers, Power
- ☐ Scrapers, Team
- ☐ Screening Equipment
- ☐ Screens, Perforated Metal
- ☐ Screens, Rotary
- ☐ Screens, Vibrating
- ☐ Separators, Air
- ☐ Separators, Gypsum
- ☐ Separators, Magnetic
- ☐ Separators, Sand
- ☐ Sheaves
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- ☐ Tube Mills
- ☐ Turbines
- ☐ Unloaders, Bin
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- ☐ Unloaders, Conveyor
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- ☐ Washers, Log
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- ☐ Wire Cloth

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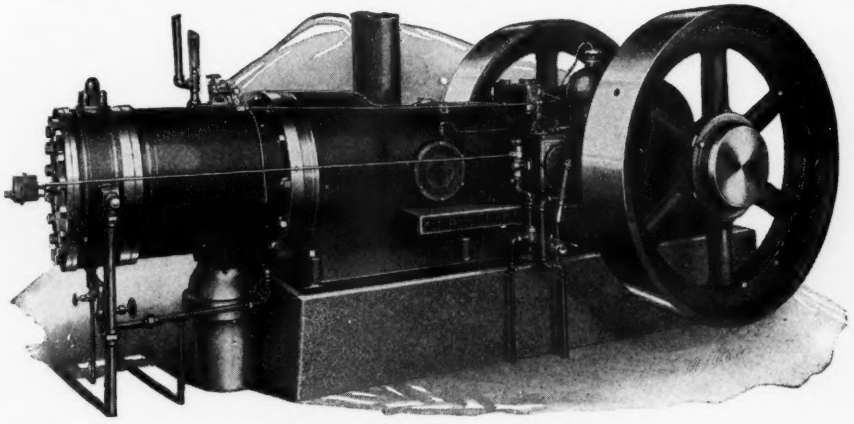
PRIMM POWER

Makes Greatest Production Possible



SAND — GRAVEL — CRUSHED STONE

A PRIMM Oil Engine will supply dependable economical power in the production of building, moulding and glass sand as well as gravel and crushed stone. PRIMM Power can be relied upon no matter what the load may be. At the limestone, cement rock and granite quarries it has proven its ability to stand up—year in and year out—producing reliable power usually at less than one half the cost of electric or steam power.

It will pay you to investigate PRIMM Oil Engines. They pay for themselves over and over again. No experienced engineers are necessary—any one can operate them.

PRIMM Service is Country wide. Our Engineers will gladly go over your power requirements with you. You will sell yourself on PRIMM Oil Engines once you thoroughly examine them and learn of the results they accomplish. Write us today.

SEMI-DIESEL

SINCE 1902

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25 H. P. TO 300 H. P.

THE POWER MANUFACTURING CO.

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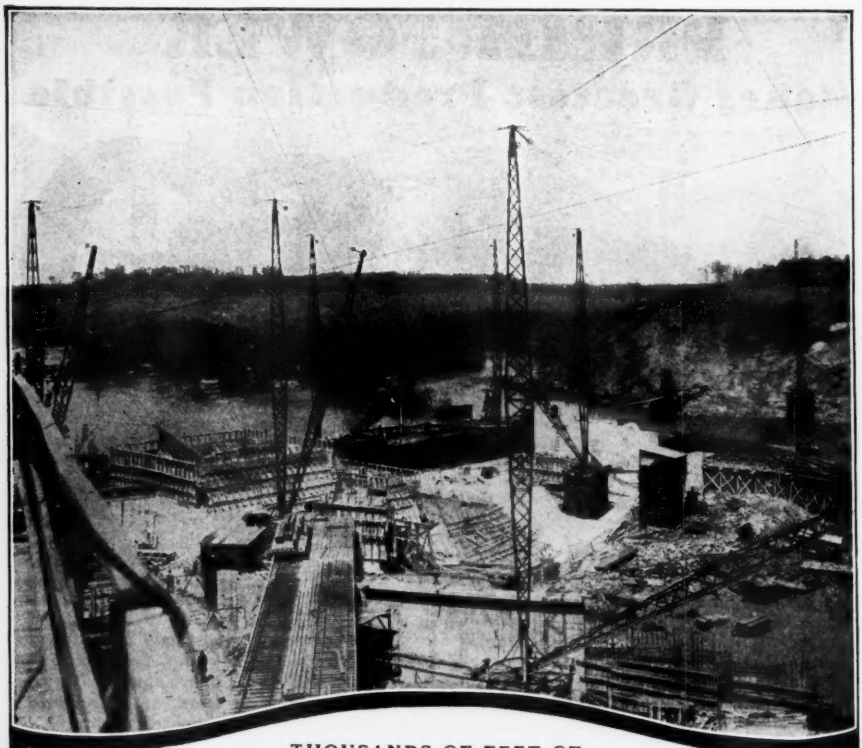

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Tape Marked
Factory certified

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HYDRO-ELECTRIC POWER PLANT

being erected for the Columbus Electric and Power Co., near Columbus, Georgia.

This is one of the many big projects being erected by Stone & Webster, Inc., of Boston.

The satisfying thing about using Williamsport Wire Rope on a big job like this, aside from its long continued, uniform service is the fact that they are the only ropes, the grade of which it is possible to identify before and after they go into service. It is a very easy matter to get the wrong grade of rope, of any other make, on an operation of this kind—often with serious results, because they lose their identity when they leave their original reel.

This cannot happen with Williamsport Ropes, except through pure carelessness. Careful workmen prefer Williamsport Wire Ropes, and the Telfax Tape protection woven into them, for this reason.

Write for interesting information about our "Telfax" protection.

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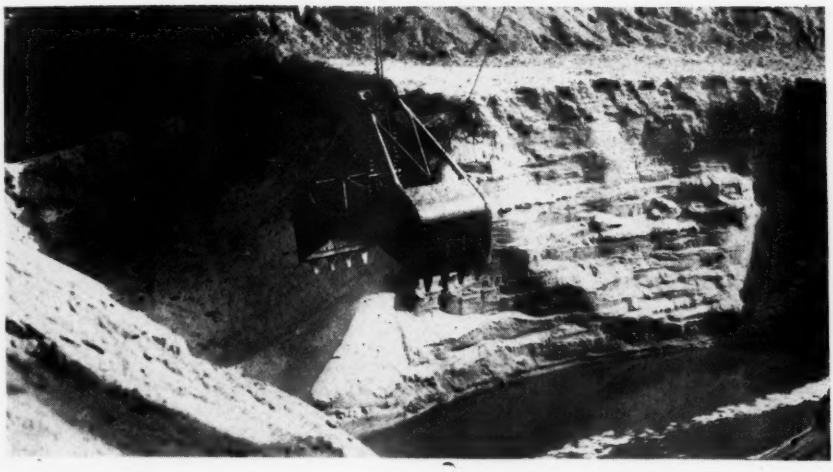


Clam Shell Bucket

Orange Peel Bucket

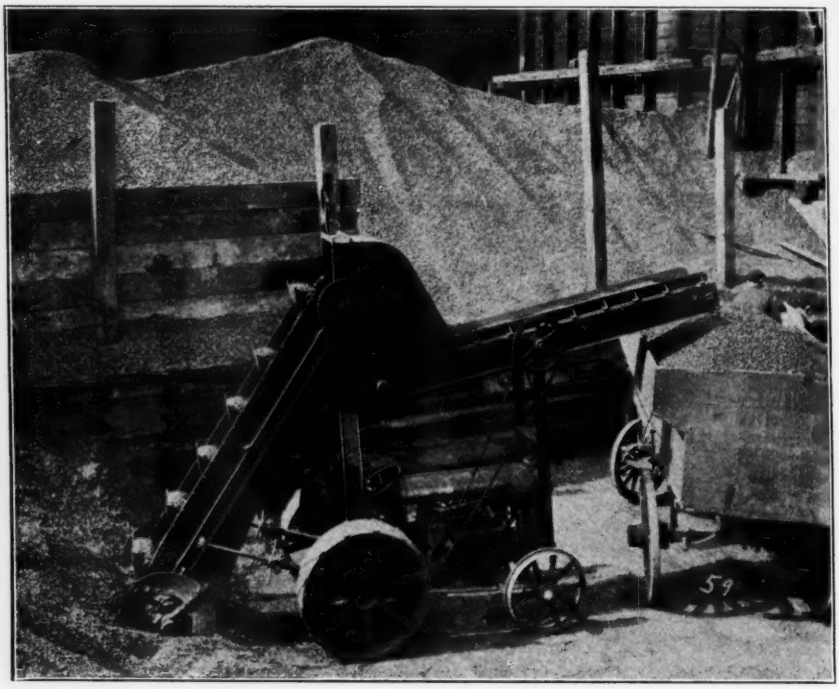
Drag Line Bucket

Stamina to survive the hard drives

Bucket stamina to survive the hard drives—construction that means speed, economical operation, and long life—these and many other advantages are described and illustrated in Bulletin 607. This Bulletin was prepared especially for sand and gravel producers—a copy will gladly be sent on request.

THE HAYWARD COMPANY
54-56 Church Street New York, N. Y.

Builders of Clam Shell, Orange Peel, Drag Line, and Electric Motor Buckets; Dredging, Excavating, and Coal Handling Machinery.



Loading at its best
or
Loading at its worst

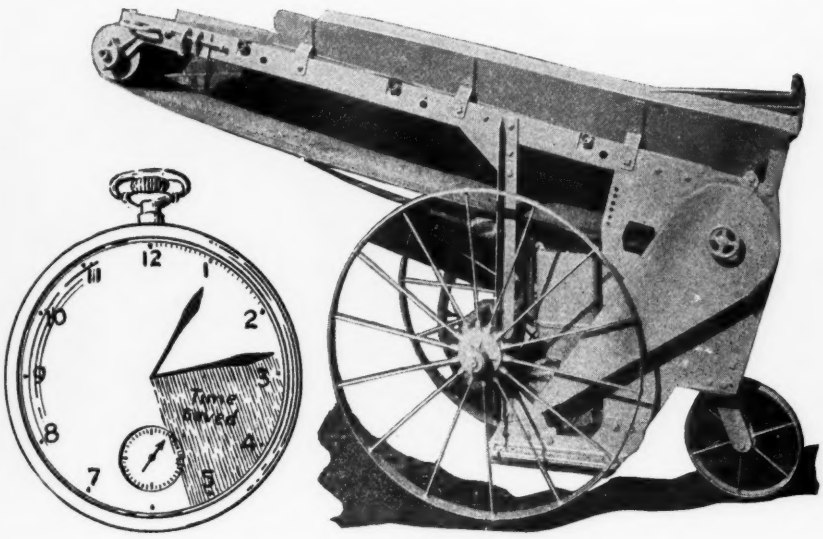
It doesn't make much difference to a Specialty Fordson Loader—the result is always the same—efficient loading under the conditions encountered.

A Specialty Fordson Loader has those features that mean efficient loading. It is easy to control, crowds while buckets are in operation independent of reverse gear. It can be crowded much or little at a time. The feeders clear a path sufficient for tractor wheels. Crowding mechanism is self contained with gears running in oil.

Of course, you want to know how much this loader costs, its capacity, etc. Drop us a line and we will gladly send you complete information.

SPECIALTY ENGINEERING CO.

Allegheny & Trenton Aves. Philadelphia, Pa.



Save loading time and you save money

Ways and means of saving time is a problem that every producer is sooner or later confronted with. In loading, many plants have been able to make great savings through the use of Ottumwa Box Car Loaders.

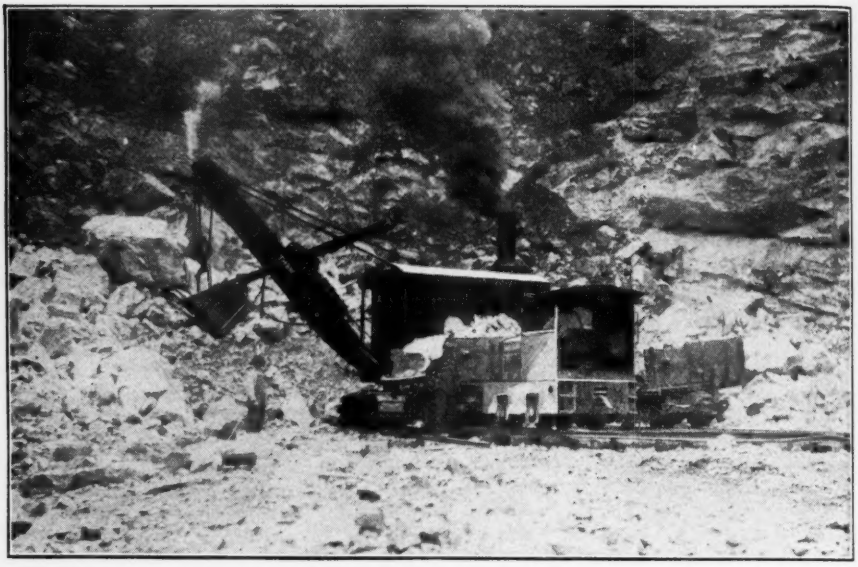
Proved savings result from the Ottumwas. They eliminate loading gangs, reduce costs, prevent delays, increase capacity—and as a result pay big dividends. An Ottumwa on the job will put dollars in your pocket.

The Ottumwa is manufactured with electric or gasoline power. It has roller and ball bearings throughout, and latest improved Alemite greasing system.

Write for complete information and prices.

OTTUMWA BOX CAR LOADER CO.

OTTUMWA, IOWA



The Bull Dog of Shovels

One quarry owner calls his Thew Shovel "The Old Bull Dog."

It's an apt nickname. If you ever saw a blooded bull dog fight, and a Thew handle rock, you will see the similarity.

A bull dog or a Thew keeps on fighting against heavy odds long after others give up and quit. There's a reason in both cases.

The bull dog has had stamina carefully bred into him through a long line of fighting ancestors.

Thew stamina has been developed through the experience of 30 years in building fighting shovels.

Rock handling is a fighting job. You need a fighting shovel to stand up to it year after year.

A Thew will do it. Ask any Thew owner.

THE THEW SHOVEL COMPANY, LORAIN, OHIO

Thew Lorain Shovels

Dig Faster—Last Longer

Pit and Quarry

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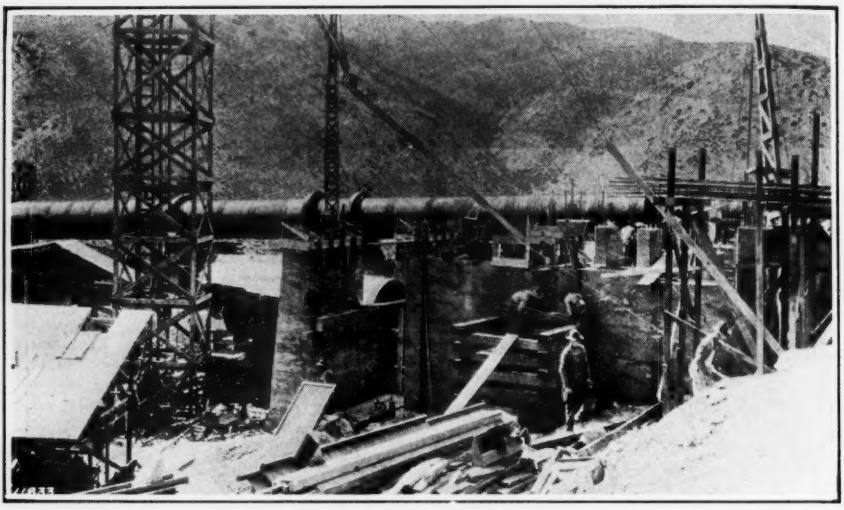

Sun Portland Cement Co. Uses a *Vulcan* Kiln!

CORRECT kiln design and installation is an important factor in any Cement Plant. That a Vulcan Kiln was used by the Sun Portland Cement Co. is significant.

The installation at the Sun Plant shown above is 9 ft. and 10 ft. in diameter and is 210 ft. long. It is supported on four tires.

That this Vulcan Kiln is entirely satisfactory is attested in the several letters from officials of the company. This fact is not surprising, as every one of our 349 kilns installed at 12 different companies are still in use — some for as much as 25 years — and are giving entire satisfaction.

Send for the Vulcan Catalog on Kilns, Coolers and Dryers.

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Est. 1849

VULCAN of WILKES-BARRE KILNS

Pit and Quarry

A Semi-Monthly Publication for Producers and Manufacturers of Sand, Gravel, Stone, Cement, Gypsum, Lime and Other Non-Metalic Minerals.

VOL. 10 CHICAGO, ILL., JULY 1, 1925 No. 7

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The Barber-Greene wheels can be swiveled. We have them here set at a slight angle.

Here they are set straight for quick easy moving.

Now the wheels are set to pivot, with the charging hopper as a center.

Send this coupon to Barber-Greene Company, 490 West Park Avenue, Aurora, Ill., for N Catalog ☐ and information on Bucket Loader ☐.

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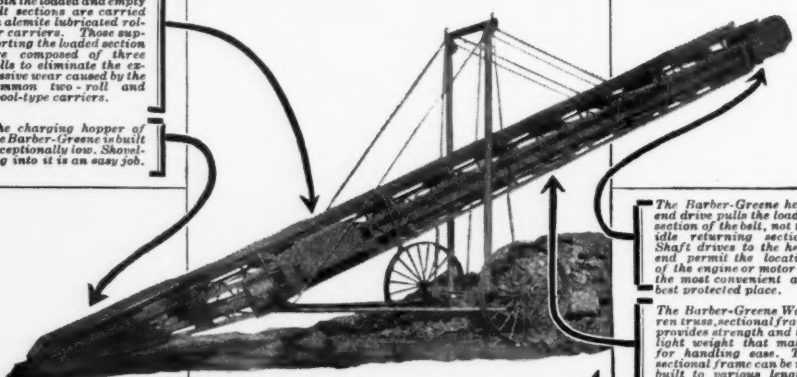
Both the loaded and empty belt sections are carried on alemite lubricated roller carriers. Those supporting the loaded section are composed of three rolls to eliminate the excessive wear caused by the common two-roll and spool-type carriers.

The charging hopper of the Barber-Greene is built exceptionally low. Shoveling into it is an easy job.



The Barber-Greene head end drive pulls the loaded section of the belt, not the idle returning section. Shaft drives to the head end permit the locating of the engine or motor in the most convenient and best protected place.

The Barber-Greene Warren truss sectional frame provides strength and the light weight that makes for handling ease. The sectional frame can be rebuilt to various lengths from fifteen feet to sixty.

4

The Portable Conveyor that Drives Handling Costs Down—Down—Down

There's a lot behind the ability of the Barber-Greene Ideal, Portable type N Conveyor that helps it to drive handling costs down, down, down. Exceptional handiness and ease of operation have a lot to do with it.

For instance, the charging hopper is exceptionally low. And here's how that saves a lot of hand labor and cost. It can be used beneath low hoppers—and if hand labor is used, shoveling is fast and comparatively easy into such a low charger.

The other end of the Barber-Greene, type N, has a definite bearing on the driving down of costs. It can be raised or lowered quickly by means of a crank and a brake.

This means that it is an easy job to fill a bin and then swing to loading a truck, wagon or car.

On both these jobs and on stock-piling, it eliminates the need of shovel trimmers or pile builders.

The Ideal type N conveyor can be readily moved. It is mounted on a truck fitted with two independently swinging wheels. They can be set in any position desired.

For example, they can be turned so that the discharge end of the conveyor swings in an arc with the charging hopper as a center. That's a mighty handy trick when you're building up a stock pile.

There are a lot of other things about the Barber-Greene Ideal, type N Conveyor, the alemite lubricating belt rollers, the head and pulling drive with the tail end drive's advantages, the husky, light weight Warren truss frame, and a lot more that make for fast handling and long life.

They are all in our N Catalog. In addition it will be worth your while to ask for information on the efficient Barber-Greene Bucket Loader.

The coupon in the upper right hand corner will bring both. Why not use it?

BARBER-GREENE COMPANY, 490 West Park Avenue, Aurora, Illinois

Representatives in fifty cities

BARBER GREENE

Portable Belt Conveyors Self Feeding Bucket Loaders

Coal Loaders . . Automatic Ditch Diggers . . Coal Feeders

Pit and Quarry

Vol. 10 Chicago, Ill. July 1, 1925 No. 7

Accident Prevention and Safety First

ACCIDENT prevention is a problem which has become increasingly important during the present quarter of a century. To lessen the number and degree of accidents, to anticipate the economic loss which they occasion, as well as to provide equitable remedies for incapacitated workers, are some of the most important phases of the problem. One of the most interesting developments along this line is the definite and well organized action on the part of quarry owners and operators. The outlook for future progress toward safety is very encouraging. The quarry industry has been somewhat slow in getting into action but promises to make up for lost time with the progressive ideas of leaders in this particular field.

There is no doubt that Mr. E. E. Evans, President of the Ohio Macadam Association, is a believer that one cannot dream his projects to success; that action is essential. He recently called a meeting of members of his association for the purpose of discussing practical ways and means of promoting accident prevention and safety first in Ohio quarries. As a result of this meeting there was formed a Quarry Section of the National Safety Council. This section was organized last month with the following officers: Mr. E. E. Evans, Chairman, and Mr. Don C. Souder, Secretary. Mr. Evans, who is General Manager of the Whitehouse Stone Company of Toledo, Ohio, has long been an earnest student of the industry. As an experienced quarry operator he knows the needs and problems in the field of the non-metallic industry. His efforts to get organized action on accident prevention and safety first are highly commendable.

Mr. Souder has been Manager of the Insurance Department of the France Stone Company of Toledo, Ohio, for several years and is thoroughly familiar with insurance rates, workmen's compensation, and allied subjects. His experience will be of value in this work which he has undertaken.

With these men at the head of the Quarry Section of the National Safety Council the movement will receive the support of every quarry owner and operator. This section will be the means of standardizing safety methods and will establish a basis for a comprehensive, intelligent investigation of liability and workmen's compensation insurance rates in this branch of industry. Operators who have given little thought to the subject can voice their approval and goodwill by becoming members of the Quarry Section of the National Safety Council. Since the Section has been organized for the purpose of dealing with the problems of this particular industry, it merits the cordial support and cooperation of those interests it represents.

That this Quarry Section of the National Safety Council is a practical proposition is assured by the fact that plans have already been made for a program and meetings of the Section at the Annual Congress of the National Safety Council in Cleveland, Ohio, to be held from September 28th until October 2nd. The Quarry Section will also issue news letters, monthly if possible, to members and to others in the industry. Many other plans are being formed which will offer ample opportunity for quarry owners and operators to meet on a common ground of mutual interests. It is a movement for the betterment of the industry and the elimination of costly human waste through hazardous practices.

Full details and information regarding the Quarry Section of the National Safety Council can be obtained by addressing the Quarry Section of the National Safety Council, 168 North Michigan Avenue, Chicago, Illinois. This council is cooperative, and non-profiting and was organized for the purpose of rendering service in accident prevention.

The Recent Anti-Trust Decision

APPARENTLY the recent decision of the Supreme Court of the United States in the Cement Manufacturers Protective Ass'n and the Maple Flooring Manufacturers Ass'n case has met with general public approval. There is today a tendency in public opinion to condemn government interference with business, particularly through the action of commissions. It is doubtful if the court would have acted as it did had not the pulse of the general public on the general question of government interference been felt. At that, the Supreme Court was divided 4 to 3 on the case.

Several trade association executives seem anxious to place a most liberal interpretation of the decision. Both Secretary of Commerce Hoover and Attorney General Sargent, in commenting upon the decision, have stated that any conspiracy to fix prices or to control distribution is as much a violation of the law as occurred previously. Federal officials have expressed the opinion that more than half of the present trade associations have been engaged at one time or another in price fixing or the limitation of output.

The charges of the government in two other important cases not yet brought to trial are similar to the case in question. These charges involve the Southern Pine and Western Pine Associations. A re-examination of these and other association cases is now in progress by the Department of Justice to determine the effect of the court's decision upon them.

James A. Emery, general counsel for the National Association of Manufacturers, has pointed out the significance of the recent decision as follows:

"1. That an association or combination of persons or corporations may fairly and openly compile and distribute timely trade information to their members or associates, providing such association or combination is not reaching or attempting to reach an agreement or arrangement to restrict production or prices, or divide territory, or otherwise artificially restrict competition among themselves.

"2. That the data which may be lawfully compiled and distributed under such circumstances may include: unidentified information as to the cost of the product, the price received for it in closed transactions, the volume of such production, the stocks on hand, and the approximate cost of transportation from the established center of shipment to the various places of consumption.

"3. That a tendency to uniform price for a standard article following the distribution of legitimate trade information merely indicates the natural operation of economic law following the exercise of a valid right. It is not in itself an index of illegal trade restraint.

"4. That such associations, or persons, or corporations within the same industry, subject to the restrictions stated, may freely meet and discuss the information thus obtained.

"The opinion does not mean that associations previously condemned are legitimized. It gives no license to misuse timely trade information or by any device or disguise use a trade association to artificially control production, prices or the territory of competition. It cannot be emphasized too strongly that the opinion merely affords each industry an opportunity to collectively assemble essential information which substitutes intelligent for ignorant competition. It gives each industry an opportunity to set up self-government in the use of this new freedom and establish a custom which will sternly confront any threatened abuse of this valuable right. It is confidently anticipated that it will mean the growth of a common law of sound custom within each industry which will make unnecessary the further intervention of government, to prevent or regulate abuse."

Liberty carries with it responsibility. Will business and financial leaders exercise such business statesmanship that the goodwill of the general public and its friendly attitude will be cultivated? Will the Supreme Court decisions in the case of the Cement Manufacturers Protective Association and the Maple Florring Manufacturers Association prove helpful or harmful to business?

Savings Result From Joint Operation Of A Cement And Lime Plant

Written Expressly For Pit and Quarry By E. D. ROBERTS

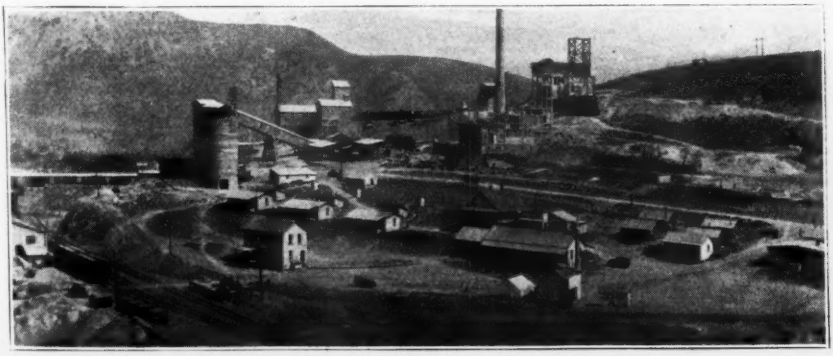
The author of this article designed and supervised the constuction of the coal pulverizing plant of this operation in 1924. During the building of the plant itself in 1923, he was associated with the Sun Portland Cement Company in the design and layout of the plant structures and machinery. Mr. Roberts is now Assistant Professor of Civil Engineering at Marquette University.

Editor.

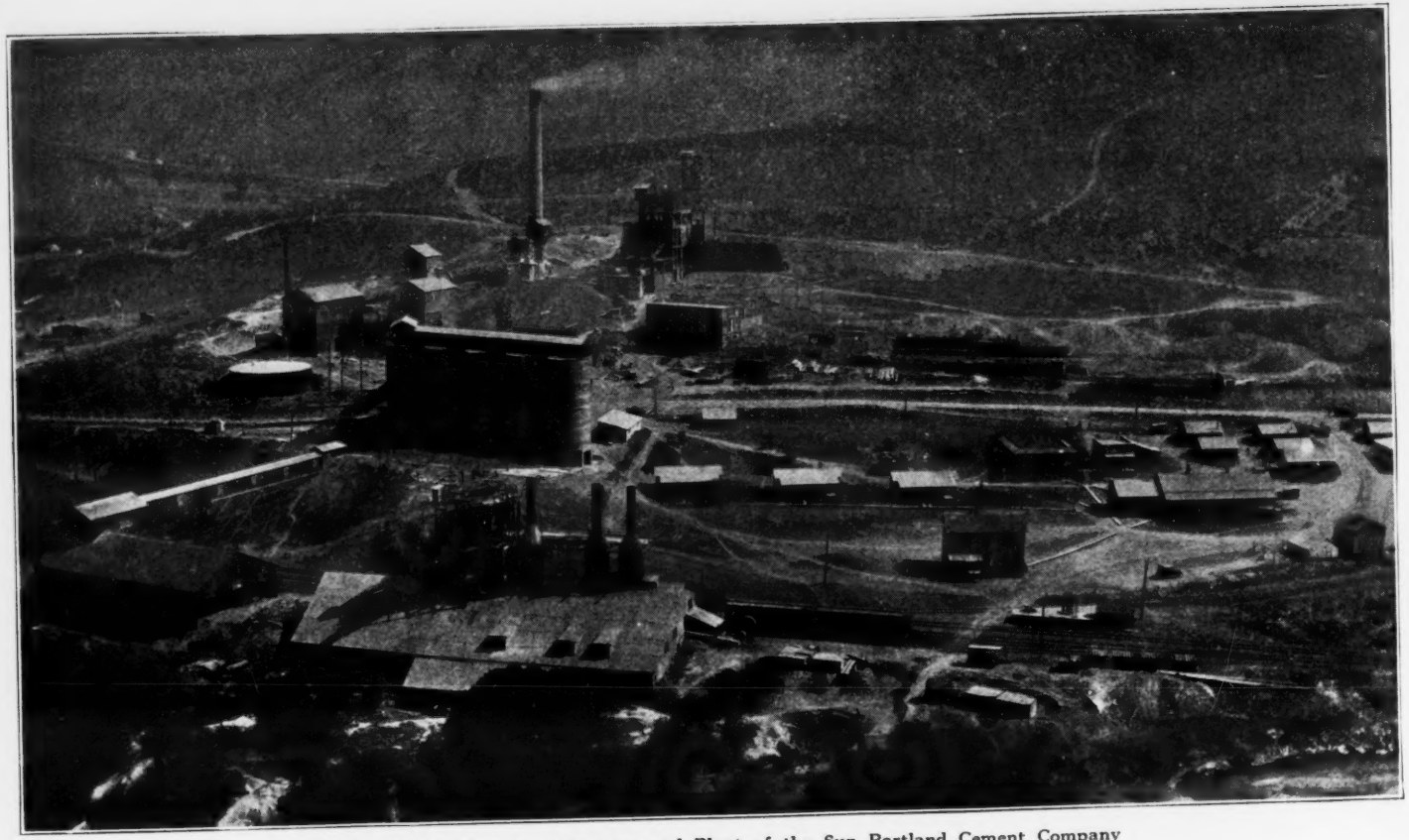
DURING the summer and fall of 1922 a serious shortage of cement developed in Western Oregon. Several parties interested in the manufacture of cement investigated and decided that there was good opportunity for another cement plant in Oregon. Several deposits were considered, but after a few negotiations the lime plant and deposits of the Certainteed Products Company at Lime, Oregon, were purchased. By the spring of 1923 all negotiations had been completed, and the Sun Portland Cement Company organized and incorporated under the laws of Oregon. The plans were drawn, and the plant built ready for operation by fall. A new record was established for speed in constructing this type of plant.

Lime, Oregon, is 4½ miles west of Huntington. The plant site is on the broad canyon of the Burnt River and on the O. W. R. & N. branch of the Union Pacific Railroad. In laying out the plant the engineers took advantage of the topography which resulted in a considerable power saving in the manufacture of cement. Then by operating the lime plant, taken over from the Certainteed Products Company, in conjunction with the cement plant a saving was also made in the manufacture of lime. The limestone deposit is in fact a large mountain. The exposed face of this lime deposit is free from overburden. There is enough rock proved to run a three kiln cement plant for 150 years. This limestone deposit is on the north side of Burnt River, and the lime kilns and the new cement plant are on the south side of the river.

The old quarry was about half way up the mountain with a considerable expanse of floor. This quarry was also situated at such an elevation that the material could be transported to the new cement mill by an aerial tramway operated by gravity. This method of transportation had been in effect in transporting the rock to the lime kiln by the Certainteed Products Company. Thus the expense of opening another quarry, or of operating two quarries, or installing another tramway from a new quarry to the lime kiln was eliminated by using the old quarry. Another saving resulted in the operation of both a lime and cement plant, as what had been waste to the Certainteed Products Company is now used in the manufacture of



The Plant of the Sun Portland Cement Company



A View of the Limestone Quarries and Plant of the Sun Portland Cement Company

cement. As the lime kilns are of the vertical type, it is advisable to use large hand picked rock to allow the passage of the burning gases through the lime. Under the present methods the limestone for the lime kilns is picked out first and the remainder is loaded into quarry cars by a steam shovel and used in manufacturing cement. Previously this finer rock had been transported to a waste dump.

In the quarry operations an Ingersoll Rand air compressor is used in operating Ingersoll Rand jackhammer drills. Horizontal 20 foot holes are driven for setting blasts. The broken stone is loaded into Western 6 yard side dump cars by a Marion gasoline electric shovel mounted upon a caterpillar tractor and with a ¾ yard bucket. The cars of rock are hauled by a Fordson tractor to a crusher bin which is on the level with the quarry floor. The stone is fed from this bin to a number 20 Telsmith gyratory crusher which reduces it to a maximum size of 2 inches.

The stone from the crusher falls by gravity to a 24 inch belt conveyor, 30 feet centers, and is conveyed to a large loading bin at the upper terminal of an aerial tramway which is 2000 feet long. The loading bin which feeds this tramway is of wood construction and has a capacity sufficient to supply the plant for several days. The aerial tramway was equipped and installed by the American Steel and Wire Company. The 2000 foot tramway is operated in one span making a total drop of 100 feet in the entire distance. The cables are anchored at both ends in concrete. The loaded buckets are carried by a cable 1⅜ inches in diameter while the empty buckets are carried by a ⅞ inch cable. The haulage cable is ⅝ inch long-lay and carries 1700 pound buckets at a speed of 500 feet per minute delivering at the lower terminal at the plant 8 tons of crushed rock per hour when operated at capacity. A 20 H. P. motor starts the tramway in motion, and it controls the speed of the line.

The aerial tramway transports the crushed rock to the dry mill and dumps it into the feed bin over the kominuter or into an open storage space where enough stone to operate for ten days is kept in reserve. This open storage is divided by a wall so the shale and limestone can be kept apart. Material from this open storage is reclaimed by a tunnel belt conveyor 150 feet in length. The stored material is dropped through sliding gates in the roof of the tunnel onto the belt conveyor which delivers the material to a bucket elevator which discharges into the feed bin over the kominuter. This same bucket elevator handles the shale to the shale bin, which is over the kominuter and alongside the limestone bin.

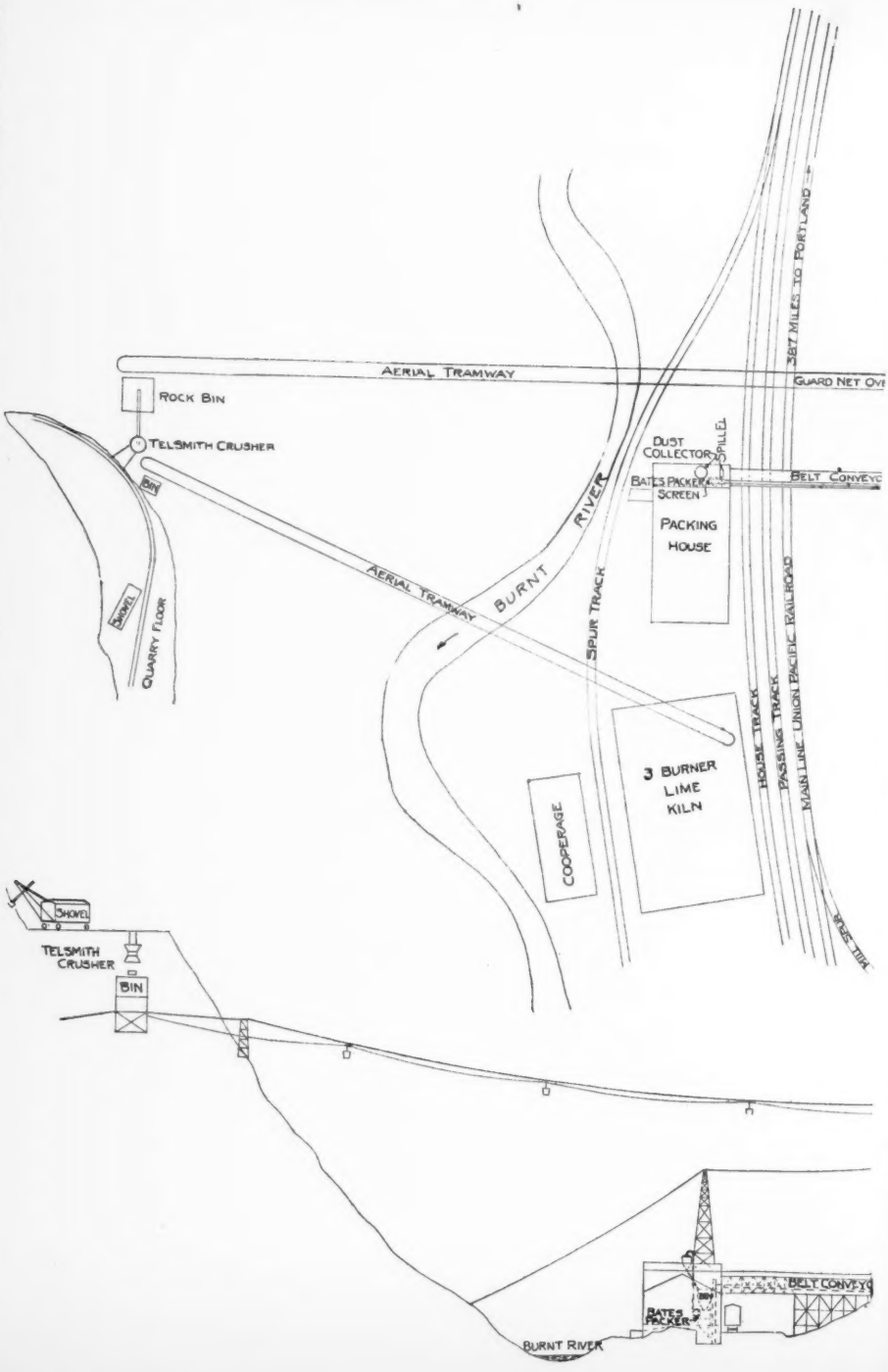
The shale is secured from a quarry two miles west of the plant and alongside the main highway. The shale is brought by a dragline bucket to a hopper over a number 8 Telsmith crusher. This crusher reduces the shale to two inches and less. The discharge from the crusher is elevated to a storage bin. Motor trucks load from this bin and carry the shale to the plant where they dump into the shale section of the open storage previously described. A 25 H. P. Diesel engine operates the dragline, crusher and elevator belt by means of a line shaft and transmission belting.

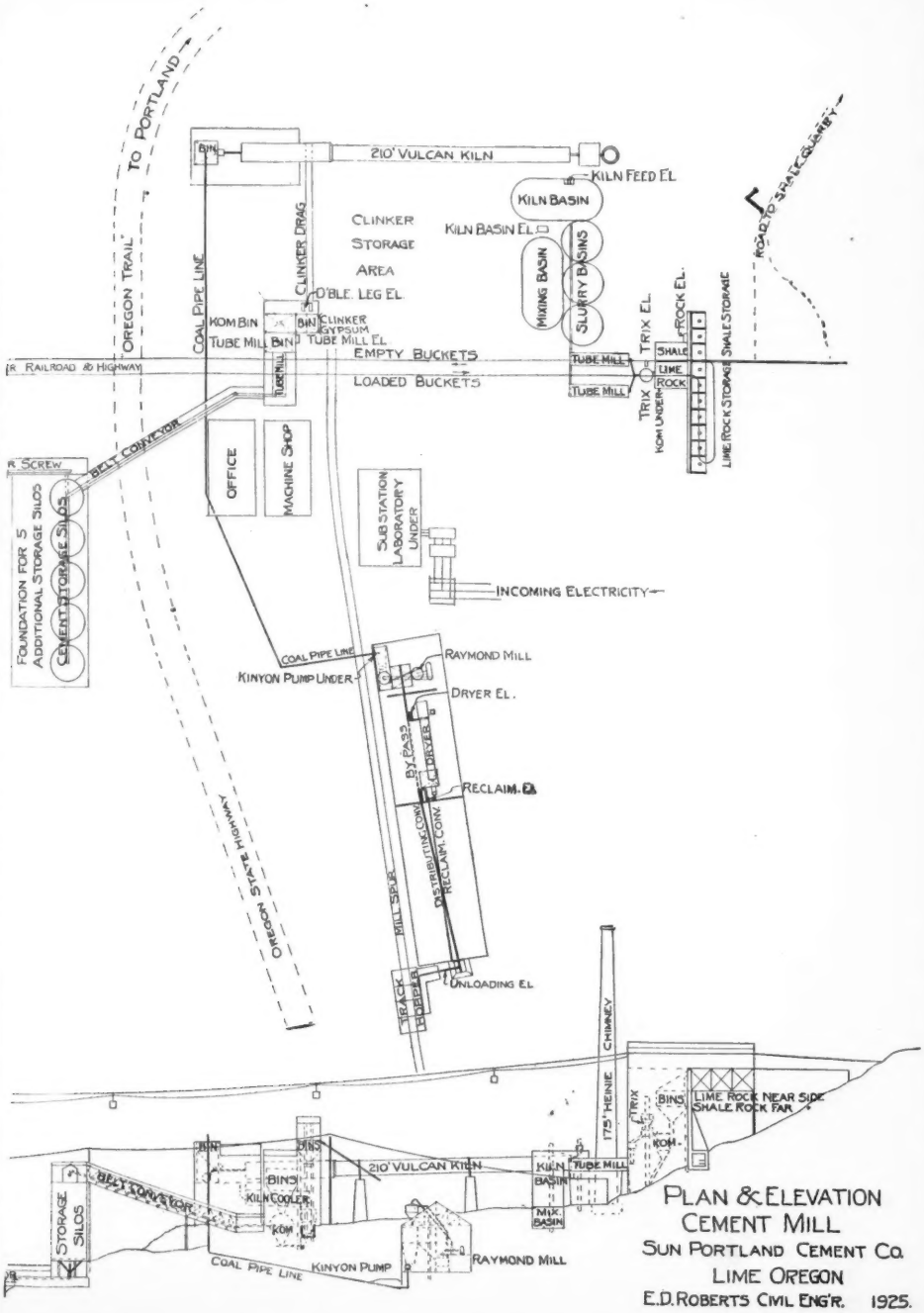
A rocker on the limestone bin and another on the shale bin regulate the feed into the wet kominuter. This is a number 85 F. L. Smidth kominuter. It is charged with chrome steel balls which reduce the material to 20 mesh. The limestone and shale are mixed in the kominuter in the proportions of 77 per cent limestone and 23 per cent is added to the mixture.

The discharge drops to an elevator which discharges to a Trix centrifugal mill. Here the fines and coarse materials are separated. The fines slide through a trough into either or both raw grinding Smidth tube mills. The coarse material is carried back to the wet kominuter for regrinding. Each of the tube mills is 6 feet in diameter and 18 feet long. They are charged with ⅞ inch Jeffrey manganoid balls and grind the material until 96 per cent passes a 200 mesh screen.

The slurry falls from the tube mills into a slurry trough through which it is propelled by a screw conveyor. There are openings at the proper points in the slurry trough through which the slurry may pass into any one of three slurry basins. These slurry basins are built of concrete each one with a capacity of 250 barrels. The slurry in the slurry basins may be drawn off into the mixing basin or directly into the kiln elevator. The slurry in the various basins is subjected to mechanical

A View of the Limestone Q


AERIAL TRAMWAY
GUARD NET OVE
ROCK BIN
TELSMITH CRUSHER
BIN
SHOVEL
QUARRY FLOOR
AERIAL TRAMWAY
BURNT RIVER
SPUR TRACK
DUST COLLECTOR
SPILLEL
BATES PACKER
SCREEN
BELT CONVEYO
PACKING HOUSE
387 MILES TO PORTLAND
HOUSE TRACK
PASSING TRACK
MAIN LINE UNION PACIFIC RAILROAD
3 BURNER LIME KILN
COOPERAGE
SHOVEL
TELSMITH CRUSHER
BIN
BELT CONVEYO
BATES PACKER
BURNT RIVER



PLAN & ELEVATION
CEMENT MILL
SUN PORTLAND CEMENT CO.
LIME OREGON
E.D. ROBERTS CIVIL ENG'R. 1925.

agitation constantly. Samples are taken hourly for analysis. The arrangement of basins is such as to insure continuous operation of the tube mills and kominuter in case of trouble in any of the basins. The basins are also constructed to care for two additional units in case the anticipated need for them arises.

A double leg elevator conveys the slurry from the kiln basin up to a chute which leads into the kiln feed. Only one leg of this elevator operates at a time in order that the other may be examined and put in order in case of trouble. A Ferris wheel feeder introduces the slurry into the kiln. This is a Vulcan Iron Works kiln 210 feet long. The excess gases from the kiln escape through a 175 foot reinforced concrete chimney designed and built under the direction of the Heine Chimney Company. This chimney has a diameter at the bottom of 12 feet and at the top of 8 feet.

The kiln discharges the clinker into a chute leading to a Smidth cylindrical revolving pressure cooler. The hot gases from the clinker are drawn from the cooler into the combustion chamber of the kiln. The cooled clinker drops from the cooler into a large steel storage tank or directly through onto a clinker drag. The tank was provided in case it became necessary to shut down the clinker drag. The drag conveys the clinker to the boot pit of the clinker elevator which elevates it to the clinker storage bin. This elevator is also a double leg affair. It also elevates the gypsum to a storage bin alongside the clinker bin.

Both bins are above the dry kominuter. Material from each bin is led to a common point where it is dropped into a measuring car that conveys the mixture a few feet and drops it to the dry kominuter bin. Gypsum is about 3½ per cent of this mixture. The clinker storage bin is provided with an overflow spout that discharges excess material in case the burning process is providing more clinker than is being ground at the time. This excess material falls to the ground and is dragged away by a drag scraper which later returns it and drops it into the clinker elevator boot pit if the grinding process requires more material than is being furnished by the kiln.

The dry kominuter bin is placed directly over the kominuter feed. The kominuter is charged with 12,000 pounds of 4 inch steel balls. The discharge from the kominuter is conveyed by a 12 inch screw conveyor to a tube mill elevator where it is elevated to another screw conveyor which feeds to a tube mill bin. Later this conveyor will be extended as additional units are added. The tube mill bin is directly over the tube mill feed. The material is fed to a Smidth tube mill 6 feet in diameter and 22 feet

The Limestone Storage Bin and Tramway Loading Terminal

long. This mill carries 20 tons of ⅞ inch steel balls. The product from this tube mill is finished cement ground so that 85 per cent will pass 200 mesh. The finished cement from the tube mill emerges into a 16 inch screw conveyor which discharges onto an inclined belt conveyor 16 inches wide and 160 feet long which delivers to a 12 inch 130 feet long screw conveyor on the top level of five concrete storage silos. This last screw conveyor distributes the cement to the various silos. The inclined belt conveyor which elevates the cement to the top of the storage silos is supported over a main highway by a Howe truss bridge that is sealed to prevent any cement dropping upon pedestrians passing along the highway.

The storage silos are built of reinforced concrete and are 50 feet high and 23 feet in diameter with a capacity of 5,000 barrels each. There are ten silos arranged in two rows of five to a row, which arrangement provides four interstice bins. Two tunnels are provided under the silos in which are housed 16 inch screw conveyors. There are nine openings in the bottom of each silo to lead the cement into the conveyor trough as needed. This arrangement of openings has practically eliminated the tendency of cement to arch over and hang up when being drawn off. The tunnel conveyors discharge into a cross conveyor along the ends of the silos. This cross conveyor discharges the cement onto a 24 inch belt conveyor that transports it through an enclosed overhead gallery across the railroad tracks and into the packing house where the cement is packed with Bates packers. From the packers the cement is trucked into cars either at the back or the front of the packing house. Later a belt conveyor will be provided to load the cars and thus eliminate the unnecessary trucking.

All machinery in the plant is operated by electricity requiring a total of about 1200 H. P. All electric motors are of Allis Chalmers manufacture. A Link Belt silent chain transmission and Foote Brothers reduction gears are used in connection with motor drives on kominuters, tube mills, elevators, etc. Power is furnished by the Idaho Power Company and comes to the plant at 66,000 volts and is stepped down to 440 volts by two outdoor transformers each of 1000 k. v. a. capacity. Each kominuter and tube mill has a 250 H. P. motor with the exception of the clinker tube mill which has a 250 H. P. motor. All elevators, troughing rolls, the hot clinker elevator and the screw conveyors are of Link Belt manufacture. All the conveyor belts are of Goodyear Tire and Rubber Company manufacture.

The wet mill is of reinforced concrete construction, as are all the slurry basins. The dry mill is of the steel mill building type. The kiln building is of reinforced concrete while the packing house is of wooden mill building construction. The main factors in determining the types of buildings used were the matter of time required to construct and the availability of material and labor.

A special feature of this plant is the guard net placed under the aerial tram where it operates over the main highway and the main line of the Union Pacific Railroad. This net is 20 feet wide and is placed on five 1¼ inch track cables held 5 feet apart by means of 1½ inch galvanized pipe spreaders. A layer of reinforcing mesh composed of ¼ inch wires was placed over this and fastened to the cables and spreaders with ⅜ inch U bolts. Over this was placed a layer of Tyler screen of ¾ opening made up of ⅛ inch wires and fastened to the reinforcing mesh with wire ties. Each side of the Tyler screen was bent up for 12 inches and held in place by an auxiliary cable.

The coal pulverizing plant was constructed during 1924. The layout for this plant provides for a contemplated increase in plant capacity sufficient to operate three kilns. A reinforced concrete hopper 14 by 40 feet was provided under the mill spur to receive the coal from bottom dump cars which were to transport the coal to the mill from Wyoming, Utah or other remote sources. Sloping sides were provided in the hopper to convey the material into a screw conveyor operating in a trench along the right side of the hopper. This conveyor feeds the coal into a pit from which it is elevated by means of an inclined endless chain bucket conveyor. This elevator drops the coal into a screw conveyor operating over a large reinforced concrete storage bin 45 by 100 feet high. A provision was made for the coal to spout directly into this storage area from the elevator in case the screw conveyor was not in operating order. This screw con-

veyor enters the mill building where a chute is provided to place the material directly in the dryer bin. A reclaiming screw conveyor operates in a trench under the bottom of the storage bin for picking up the stored coal and dropping it into the boot pit of an elevator which elevates it and conveys it into the dryer bin.

After passing through the Buckeye dryer it falls into the boot of another elevator which raises the dried coal and drops it into a screw conveyor which distributes it throughout the length of the mill bin. Provision has been made for the installation of a conveyor to take the coal directly from the end of the distributing conveyor which operates over the storage area and drop it into the conveyor. This will insure continuous operation in case of trouble with the dryer or will save drying the coal in case a coal is purchased that does not need drying.

The coal is pulverized by a Raymond mill from which it is carried by an exhauster into a dust collector and falls from there into a storage bin placed directly over a Fuller-Kinyon pump. This pump transports the coal a distance of 520 feet and raises it to a height of 60 feet through a 4 inch pipe by means of a screw feed and compressed air. The discharge from the Kinyon pump line is into a 25 ton steel storage bin placed over the kiln feed. A F. L. Smidth feeder operated by a variable speed control feeds the powdered coal into a 10 inch blow pipe line passing into the end of the kiln. The air for this feed is furnished by a Sturtevant blower.

It required six months to design and construct the coal pulverizing plant. The work was done entirely by company forces with the exception of the fabrication and placing of the steel bins, trusses, towers, etc. The mill building was constructed of reinforced concrete with steel trusses overhead. Ample provision was allowed including the setting of foundation bolts for a second unit, and space set aside for a third.

The plant is now operating very satisfactorily. When operations were started, oil was used as fuel. The operation of kiln required about 10 gallons of oil to produce one barrel of cement. The present arrangement with pulverized coal effects a great saving in fuel cost. The fuel oil installation has been retained, however, as a safeguard in the event of a coal shortage.

The present plant capacity is 1100 barrels a day, but allowances have been made which will permit this capacity to be tripled. The product is known as the "Sun Brand" and is marketed in Oregon, Washington and a portion of Idaho. The executive and sales offices of the Sun Portland Cement Company are maintained at Portland, Oregon. The officers of the company include H. A. Ross, President; George MacDonald, Vice President and Treasurer; C. T. W. Hollister, Secretary and Sales Manager and H. L. Knappenberger, Manager.

The Zeolite Water Softener

A new booklet issued by the Graver Corporation of East Chicago, Indiana, is Bulletin 509, June 1, 1925, entitled "Graver Zeolite Water Softener — Water Without Hardness."

The Graver Zeolite Water Softener is designed to give maximum results in treating water, both as to the rapidity with which the capacity of the zeolite can be utilized and the very short installation period.

The installation of the softener is exceptionally easy. Due to the use of the strainer plate instead of strainer heads with manifold piping, no concrete fill is necessary in the bottom of the softener. As soon as the softener is set on its legs it is ready for piping and filling with the gravel and zeolite. The strainer plate also gives the most satisfactory distribution of backwash water and cuts down the loss in pressure.

The company are manufacturers of Water Softeners, Hot Process, Cold Process, Zeolite, Household; Filters, Pressure; Steel Tanks, Welded, Riveted, R.I.O.W. (Riveted Inside and Outside Welded), Structural Supports, Tower Tanks, Standpipes. Any Size Tanks Erected Anywhere.

Mr. W. C. Davis, President of Foote Bros. Gear & Machine Company left on June 15th on a trip to the Pacific coast. He intends to visit each of the company's branch offices at Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Oregon, and Seattle, Washington.

On the return trip he will take the Canadian route, visiting several of the branches of Darling Bros. who are Canadian distributors for Foote Bros. IXL Products.

Dust Collecting Problems In The Cement Industry

Written Expressly For Pit and Quarry By C. H. Sonntag

IT IS a regrettable fact that, taken as a whole, cement manufacture is about the dustiest large scale operation in modern industry. To an outsider such a condition seems intolerable, and indicative of slip-shod methods and excessive waste, but to those who have been long associated with the business and know its history the reasons for the dust are apparent.

Cement making in this country had its beginning in rather small scale operations using vertical kilns and doing the grinding with buhr-stones. Kilns, if using soft coal, were smoky but not dusty. Buhr-stones are not very dusty machines—in fact not nearly as much so as some of their successors. The plants being small, the dust was comparatively limited in amount, and the operators learned to tolerate it. As the business developed, the dust nuisance increased also; but mill men have become accustomed to it and surrounding towns, if they depended largely for their existence on the cement mill pay-roll, were loathe to take drastic action against the source of their prosperity. It is true that occasional efforts to collect dust were made, and the writer has heard old millwrights tell of the crude devices used in some of the early Lehigh Valley mills. These were apparently not very successful and were abandoned in some cases, and the dust was considered an evil inseparable from the making of cement.

In a broad and general way cement dust may be considered from three view points;—that of the man who has to work in it, that of the machinery exposed to it, and that of general aesthetics, including public relations.

The Employee

The cement business resembles steel making in that there has grown up in it a large number of men who are making it their life work. These men, if they move from one plant to another, find conditions similar to those they left, and think nothing of them. An outsider coming to work in this business for the first time is likely to be seriously deterred from entering it by the dust, and many high-grade mechanics will not consider cement making when openings in other industries are available.

There is one favorable thing about cement dust. It is not poisonous, like lead and arsenic dusts, nor is it more slowly injurious to health like silica or granite dust. On the contrary it appears that cement mill workers enjoy a quite marked immunity to pulmonary tuberculosis as compared to the population in general, while it is well known that granite carvers and workers in silica mills are quite apt to die of "stone-cutters' consumption". This latter appears to be caused by tiny particles of silica that lodge in the lungs and, being insoluble, remain indefinitely to set up irritation and prepare the way for serious disease.

Cement dust is apparently slowly soluble in the fluids of the body, and so does not remain in the lungs to cause irritation. Further than this, it would seem that the presence of lime in the lungs has some specific protective influence against tuberculosis, for freedom from this disease has been noted among others exposed to calcareous dusts, such as limestone carvers and grinders and workers around lime kilns and hydrated lime plants.

Much of this information was gathered by one of the California cement mills in contesting a suit against them for dust damage brought by neighboring orange growers. Similar facts are brought out in one of the bulletins on industrial dusts published by the United States Bureau of Health.

The Machinery

In the last few years a change has taken place in the arrangement of the auxiliary machinery in cement mills. In new construction, elevators, conveyors and similar equipment are being driven directly from individual motors through enclosed spur or worm speed reducing gears. This gives almost complete freedom of ar-

*Consulting Engineer, Cape Girardeau, Mo.

rangement, but perhaps more important is the fact that no belts and practically no chains are needed.

A belt, if large enough for its work, made of good material, and installed and run under suitable conditions, is fairly reliable, but unfortunately these conditions were not obtained in the average cement mill. One of the principal factors militating against good belt service is the constant presence of dust. A leather or canvas belt when in good condition contains oils and waxes that are worked into it to lubricate its fibres. Dust will and does adhere readily to such a belt, and especially to the clean surface next to the pulleys. We then have the belt faced with an abrasive, which puts a high polish on iron and steel pulleys and wears out paper ones. Then the belt slips, and we apply a dressing to make it do its work, and good dressings cost almost as much as butter. These preparations make the surface of the belt and pulley sticky, and a mixture of dust and dressing collects on them in irregular masses that must be scraped off. Belt manufacturers constantly advise that their product should be run reasonably slack, but slippage does not usually permit this in cement mills. On the contrary, they are commonly run so tight that they break at the splice and finally wear out long before they should. The prematurely worn out belt has cost money, the excessive amount of dressing applied to it has cost money. and the shut-downs to clean and splice it several times during its life probably cost more money than both the other two items. By far the larger part of this expense is due to the presence of dust in the air.

In addition to its effect on belts, cement mill dust is hard on bearings, for when suspended in oil it forms an abrasive mixture that wears out shafts and bearings long before their time. It is for this reason that many mills in this industry use grease lubrication on countershaft bearings, though it is not in general as reliable and economical as oil used in equipment designed for it. The grease forced out at the ends of a bearing forms a constantly renewed seal against the entrance of dust, while the average shaft bearing for oil lubrication is not sufficiently dust tight to keep the oil clean. An exception to this is the case of motor bearings. These are made with close clearances, and may be fitted with felt dust collars. As a consequence excellent service may be had from them even in cement plants provided the oil is occasionally changed and the reservoirs washed out with gasoline or kerosene.

Aesthetic Considerations

There can be no question as to the fact that public opinion as to certain preventable conditions in industry is slowly but surely changing. Perhaps the rising standard of American life has something to do with this, but what ever the reason, the sentiment of the people is tending toward improvement in things that were once considered inseparable from various manufacturing processes, and due consideration for this feeling is causing executives to view these things in a different light than heretofore.

Confining ourselves to the subject in hand, it may be said that until recently dust collection was figured purely on a dollars and cents basis on which money might be directly made or lost. This is not a random statement. Cement mill executives are just as keen to see new opportunities for profit as those of other industries. We can all remember the activity in collecting kiln stack dust that followed the rise in the price of potash during the war. Several efficient designs of collectors were brought out and much money was spent in installing them; but when the price of potash returned to normal there was no direct profit in operating these collectors, so that most of them were shut down and are now standing idle.

Nevertheless, the last word on collecting kiln stack dust has not been said. The orange growers of California have for several years compelled some of the manufacturers in that state to care for their dust on penalty of having their mills closed down. New plants built near large cities have been designed for the wet process, and older mills similarly situated have been changed from dry to wet, one execellent reason being that less dust comes from the stack of a wet process kiln. It seems to be just good business to forestall the complaints and lawsuits that time would otherwise inevitably bring.

Coal dust will not usually travel as far in the air as stack dust, but it is of course far more objectionable. Other parts of the mill add their

quota, the dust from the dryer stacks and from the vents over the conveying systems in the grinding departments being the worst offenders. Perhaps the most serious condition occurs when a high wind arises after several days of calm, dry weather. The wind will whip up the dust that has settled on the roofs and around the yard and carry it sometimes for a mile or more. At such times conditions around the mill are extremely disagreeable.

Civic conditions as to cleanliness and sanitation in any community are largely what the women make them. This is just as true in an industrial village at a cement plant as it is in any other settlement. It does not take very long to discourage a housewife who finds her yard and porch covered with cement dust, her washing spotted with coal dust before it is dry, and dust even seeping into the house and settling on the furniture. It is true that such a state of affairs cannot be debited with so many dollars and cents, but it does lower the whole tone of the community by lessening the civic pride of those that live in it, and repelling people of the best type, who will not live under such conditions. Dust prevention and collection will then be of indirect but none the less real benefit by giving the men in the mill a cleaner place in which to work, and by bettering home life in the surrounding town.

Dust Prevention

If mechanical conditions in the mill are such that dust is made and permitted to escape, some collecting device is a natural corollary; but it is sometimes possible to forestall the formation of dust, and so lessen the work of the collector. Opportunities for dust prevention may be conveniently classified as follows:-

(a) The older designs of crushing plants involved a series of crushers of decreasing sizes with elevators and screens in each stage of reduction. Such a layout is a prolific dust-maker, the sources being so numerous and scattered that an effective collector would be expensive and almost impracticable. When the rock is to be used entirely for cement making it must all be crushed to about 1½ inch size before drying and pulverizing. This can now be done in two stages only;—a jaw or gyratory crusher taking steam shovel rock, and a swing-hammer mill taking the entire product of the primary breaker and reducing it to 1½ inch. In some cases the first crusher is omitted and all the work is done in the swing-hammer mill. The elevators, if used are of the long pitch steel chain type with large buckets and moving slowly. Such a lay-out will make but little dust as compared to the crushing plant of older design.

(b) One of the worst sources of dust around some mills is the stream of crushed rock that is dropped onto the storage pile from a considerable height. If the wind is blowing, it will winnow out many of the finer particles and carry them quite a distance. The size of these particles and the distance they travel before settling is sometimes surprising. If the pile is conical and can be provided with a hollow chimney-like shaft in its center having openings in its sides at various heights, rock dumped into the shaft will fall inside it until it reaches the lowest free opening, when it will run out quietly onto the pile. This is not a perfect remedy, but it will prevent the formation of a great deal of dust. The writer has used this scheme with marked success in storing bituminous screenings.

(c) When crushed rock is dumped into cars from openings in the bottom of an overhead bin, much dust may be released into the air, and it is rather difficult to see how this may be avoided as long as the rock falls freely. In the coal industry lump coal is loaded into cars over special devices that slide the lumps gently into the car, not permitting them to fall at any time. In this case the reason for so doing is to prevent breakage of the lumps, but incidentally the operation is nearly dustless. A similar device could be used to load crushed stone, but it is doubtful whether many operators would consider it worth while.

(d) Pulverizing and fine grinding machines and elevating and conveying systems are the source of much dust. Some form of collector is essential to keep the air of the mill room clean, but much in the way of prevention can be accomplished by seeing that covers and casings on mills, elevator casings, conveyor troughs and similar apparatus are kept tight so that the least possible quantity of dust can escape. This will not only be of direct benefit in keeping the room clean, but will help the dust collector by lessening the air leakage into the system which must be cared for by the suction fan.

(e) In the old style wooden stockhouse with many small bins the stream of cement falling from the overhead conveyor is responsible for the loss of much valuable dust. If the cement is dropped into the bin through a shaft or flue with openings at intervals in its sides similar to the one described under (b), most of the fine and valuable dust will be retained in the cement. The chute must be strongly built and anchored to withstand the movement of the cement during settling and withdrawal. If the bins can be kept tightly closed along the top while filling, much of the dust that would otherwise escape will finally settle in the bin.

One of the advantages of the silo type of cement storage is that the escape of dust from the bins is reduced to a negligible quantity.

(f) The amount of dust and spill from a Bates packer depends to a large extent on the care with which the machine is kept up. If the sliding joint between the fan case and the bag spout is loose, or if the cut-off slide and the slot in which it moves are permitted to wear, much dust will get into the air during the operation of the machine. The remedy is obvious.

Dust Collection

As it is not possible to prevent entirely the escape of dust during the operation of a cement mill, one or more forms of collecting device must be used if the plant and neighborhood are to be kept in acceptable condition. Four types of these have found a place in the industry, and they may be classified as follows:-

(1) Electrostatic.
(2) Water spray.
(3) Centrifugal.
(4) Gas filters.

Electrostatic Precipitator.

This type of collector, developed through the work of Dr. F. G. Cottrell, has been discussed and explained so many times in the technical press that a very extended description of it here would be superfluous. Briefly, the dust laden air or gas is passed into narrow spaces across which a unidirectional potential of 40,000 to 75,000 volts or more is maintained. The dust particles acquire an electrostatic charge which causes them to collect on one of the electrodes, from which they later fall into a hopper underneath the apparatus.

The patent rights as applied to the cement industry are controlled by the Western Precipitation Company of Los Angeles, and the apparatus has been put to successful use in other large scale manufacturing operations, particular instances being the coagulation of sulphuric acid mist and the clarifying of smelter smoke containing arsenic trioxide and other solid ingredients that are either valuable in themselves or are injurious to the surrounding country when turned into the air.

When properly installed and operated the Cottrell precipitator is said to collect 95 per cent of the dust entering it. It may be so constructed as to stand up under exposure to many corrosive gases and vapors, and will handle gas at a temperature up to 450 or 500 degrees C.

Its principal application in the cement business has been in connection with the collection of dust and potash from kiln stack gases. A number of installations for this purpose were made during the war under the incentive of the high price of potash, but since this has come down to a reasonable figure the collection of potash from kiln gas is not in all cases attractive.

The Cottrell system will also handle any of the other dusts evolved in cement making, with the exception of coal dust. It has not come into extensive use, however, apparently because of its initial cost and the electrical hazards involved. It is understood that its sponsors will not recommend its use on coal dust or any other flammable dust because of the danger of initiating an explosion.

Water Sprays

Dust precipitation by this method has not been much used in cement mills, one reason perhaps being that it returns the collected dust in the form of mud, which can not be easily disposed of in a dry process mill. In a wet process plant there would be little call for this type of collector, as there are no rock and clay dryers and raw grinding is done wet. Sprays are finding some application for the precipitation of coal dust because collection of this in the dry condition is always dangerous on account of the chance of spontaneous combustion.

The dust-laden air may be first passed through a cyclone or centri-

fugal collector in which the major part of the material in suspension is reclaimed in the dry state, so that it may be returned to the process or otherwise profitably used. The air still carrying the finest particles, which can not be retained by the cyclone, is then passed through a water spray, from which it comes practically colorless. Fig. 1 (1) is a schematic drawing of such an arrangement that the writer has seen in use caring for the dust and furnace gas from a coal dryer. The coal mud is run into the sewer, though it could be drained and burned on stokers if its value warranted the expense of so doing.

When the gas is at a fairly high temperature, considerable water will be evaporated in the spraying chamber and will be carried out as vapor into the surrounding air. If the exposure is such that this vapor can condense and freeze on the vent pipe or roof, large masses of ice may be formed, which are likely to become quite troublesome. This should be borne in mind when laying out an installation of this sort.

Centrifugal Collectors

The principle on which these operate is so old that nearly every one is familiar with it. The collector is made of sheet metal, commonly galvanized steel, and consists of two sections;—the upper, cylindrical or nearly so, mounted vertically on top of an inverted cone which forms the lower section. At the lower end or apex of the cone is a flap valve for allowing accumulated dust to flow out but retaining the air inside the collector, which is usually under slight pressure. The dust-laden air is admitted tangentially to the cylindrical portion. Much of the dust is thrown out of the stream by centrifugal action, and the more or less purified gas leaves the collector through a central opening in the top cover.

This device, commonly called a cyclone will remove only comparatively coarse particles from the gas stream, and for complete purification its work must be supplemented by that of one of the other types described in this paper. It is commonly followed by a filter or a water spray, and serves a useful purpose in removing a large part of the dust and so lessening the work of the final purifiers. This is of real financial value, for a gas filter is an expensive machine compared to a cyclone designed to pass the same amount of air.

With the cyclone as with the other collectors, the service obtained from the fan depends on its position in the system. If it forces the air into the collector, it will be subject to the abrasion of the dust moving at high velocity and its life may be much shortened. Operators of waste heat boilers are well aware of this fact. On the other hand, if the fan can be placed after the collector, it will handle nothing but clean air and its

(1) Dust Recovering & Conveying Co., Cleveland, Ohio.

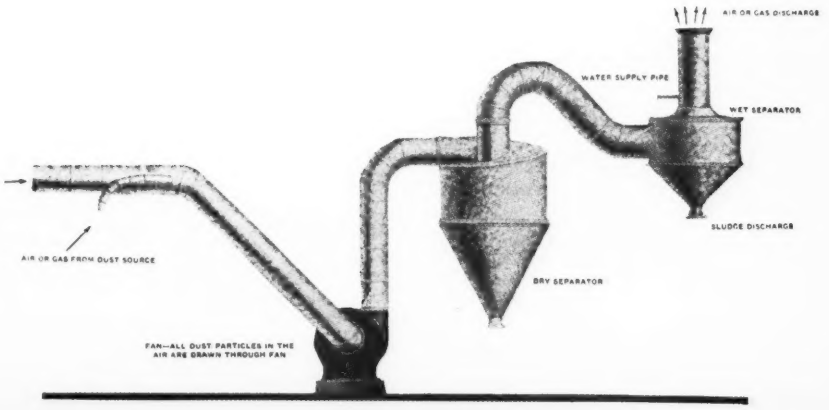

AIR OR GAS DISCHARGE
WATER SUPPLY PIPE
WET SEPARATOR
SLUDGE DISCHARGE
AIR OR GAS FROM DUST SOURCE
DRY SEPARATOR
FAN—ALL DUST PARTICLES IN THE AIR ARE DRAWN THROUGH FAN

Figure 1.

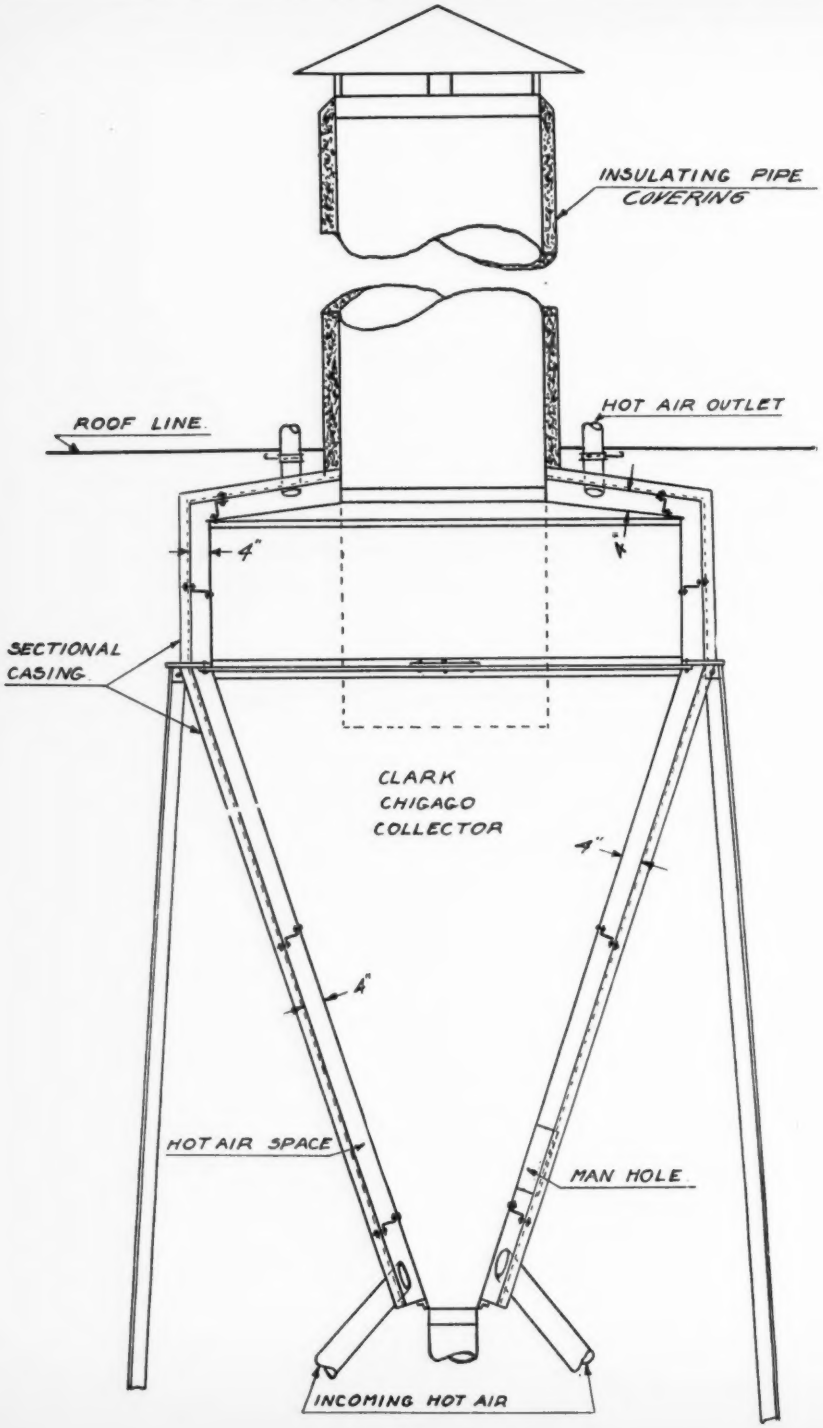

INSULATING PIPE COVERING
ROOF LINE
HOT AIR OUTLET
4"
4"
SECTIONAL CASING
CLARK CHICAGO COLLECTOR
4"
4"
HOT AIR SPACE
MAN HOLE
INCOMING HOT AIR

Figure 2.

life should be as long as in other service. In addition, the entire system will be under vacuum and there will be no dust blowing out through leaks.

It is likely that few engineers realize the dimensions to which cyclones are now being built. Several are in successful service, (2) each handling up to 125,000 cubic feet of cement kiln stack gas per minute. Such a unit is 28 feet in diameter and about 50 feet high.

Until recenly cyclones could not be used with moist air or gas because of condensation of water inside the shell. Fig. 2 (3) shows how one manufacturer has overcome this. The shell is made double, and into the space so formed, air is blown with a temperature high enough to prevent condensation. With this improvement the cyclone can be used to collect the dust from mills and conveyors in the raw grinding department of a dry process mill. It is well known that air drawn from these sources carries considerable moisture that will condense on cold metal surfaces. It would seem that a steam coil suitably disposed in the jacket space would serve to keep the cyclone warm in the absence of any source of hot air.

Gas Filters

The origin of the filter for dust-laden gas appears to have been in Germany, the object being to purify the gases from non-ferrous metal smelting furnaces. The final development of this along the original lines was the so-called bag-house, a large chamber containing tubes of cloth hung vertically and closed at the upper end. The gas passed into the inside of the tubes where the dust was retained and the air passed through.

For various reasons bag-houses have never found application in cement mills. For one thing, the investment is high and not warranted by the value of the dust collected. Also, the bags formed a very definite fire risk, and considerable value might be destroyed by a fire that otherwise might not amount to much. Then too, bag-houses were not usually designed for economy in labor, and the work of shaking the bags and gathering the dust was usually hand work, which does not correspond with the cement man's way of doing things. There was also the supposed difficulty of getting the dusty air to the bag-house, as it originates in many places in a cement mill, and also the danger of condensation of moisture on the bags.

Nevertheless the idea of cloth filtration of dust-laden air was basically sound, and has brought about the development of filters that are not only far less bulky than the bag-house, but are less costly and almost automatic. As a consequence they are finding use in ways for which a bag-house would not be considered.

Figure 3 (4) shows one type of modern gas filter. Like the old bag-house it uses cloth tubes, but that is about all they have in common. Hand labor has been entirely eliminated, for at definite periods each compartment is cut off from the stream of dusty air, clean air is blown in reverse direction through the cloth so that its meshes are opened and the possible passage of dust into the clean air compartment is prevented, and at the same time the bags are mechanically shaken. The dust falls into hoppers from which a screw or other conveyor may remove it. The shaking and cleaning mechanism is operated by compressed air and is entirely automatic. Access to the interior of the compartments for inspection and renewal of bags is provided for though the bags last from one to several years. A compartment can be easily cut out of service indefinitely if desired.

The cloth filter has also been developed along somewhat different lines. Figures 4 (5) and 5 (6) show these as brought out by two well-known builders of this class of equipment. The space available will not permit showing detail drawings of these machines, but the broken-away views will serve to indicate that they consist of a number of rectangular frames on which the screen cloth is stretched. These are arranged so as to form a continuous zig-zag partition dividing into two parts the steel case of the machine. The dusty air is admitted to one of these spaces while filtered air is drawn from the other by a fan. Most of the dust falls into a hopper underneath the machine of its own accord but to insure against clogging the suction fan is stopped every five or six hours and the screen frames are

(2) and (3) Clark Dust Collecting Co., Chicago, Ill.
(4) Dust Recovering & Conveying Co., Cleveland, Ohio.
(5) W. W. Sly Mfg. Co., Cleveland, Ohio.
(6) J. W. Paxson Co., Philadelphia, Pa.

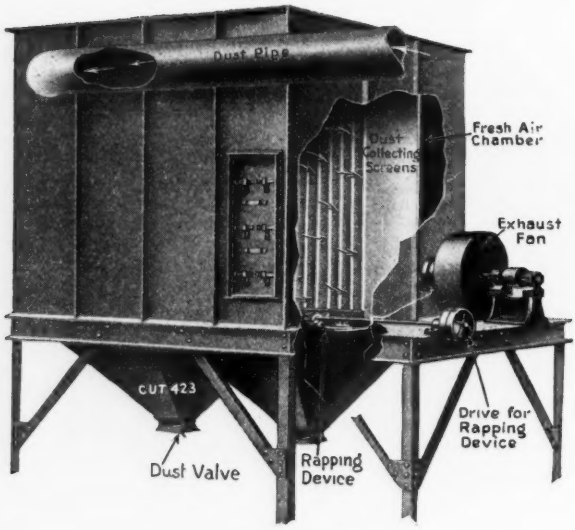


Figure 4.

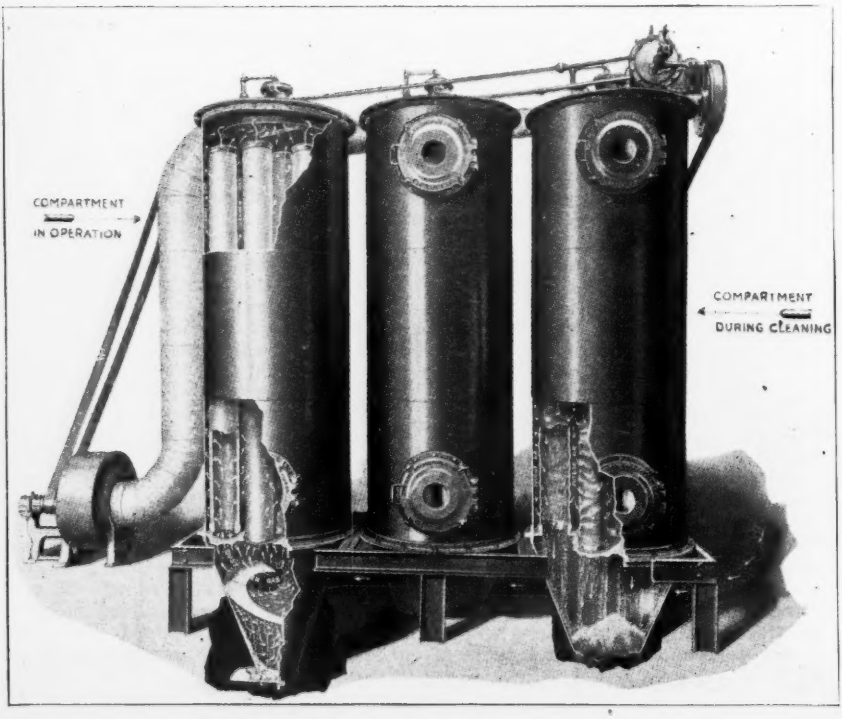


Figure 3.

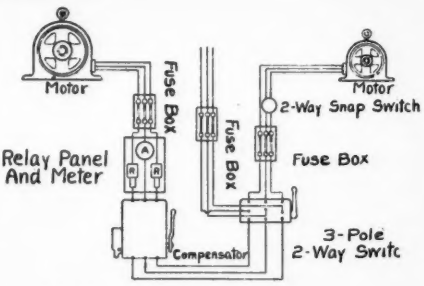
shaken or rapped for several minutes by a mechanism permanently installed in the machine for this purpose. This is usually driven by a small electric motor, and the wiring, if arranged as in figure 6 (7), will make it impossible to run the suction fan and the rapper at the same time. The shaking is in the nature of rapid vibration of slight amplitude, and is not violent enough to injure the cloth, which should last for several years.

In any of these gas filters the capacity of the cloth per square foot is much higher than in the old bag-house because of the greater and more uniform draft given by the fan, and because the frequent cleaning keeps the cloth in better condition. In consequence, a fabric with closer mesh can be used and the filtered air will be clean enough to discharge inside a building, which may be important in cold weather. The fan is on the suction side of the filter and so is not exposed to the cutting action of the dust.

The packing and loading department of a cement mill is usually a hard place to keep labor, and those who work in it are paid more than those in positions of equal skill in other parts of the mill. This is done either by a high hourly rate or by a piecework scale that will permit what sometimes looks like excessive earnings. One reason for this in the past has been the difficulty of getting men to work steadily in the old style pack-houses.

The Bates packer is in almost universal use in American cement mills. Every time a bag is pulled off, a certain amount of cement drops from the end of the spout. Cement may also blow from the sliding joint between the spout and fan case and around the cut-off slide. A certain amount of very fine dust usually blows through the fabric of the cloth bag as it is filling. These things fill the air around the machines with dust, and in the older packing rooms no attempt at prevention was made, so that conditions were reflected in the wage scale and labor turn-over.

In modern pack-houses the Bates machine is fitted with a hood entirely enclosing the back, and there is enough suction in this hood to draw into it all floating dust. The packer is set over a hopper that takes all



WIRING DIAGRAM FOR FAN & MOTOR RAPPING DEVICE

Figure 6.

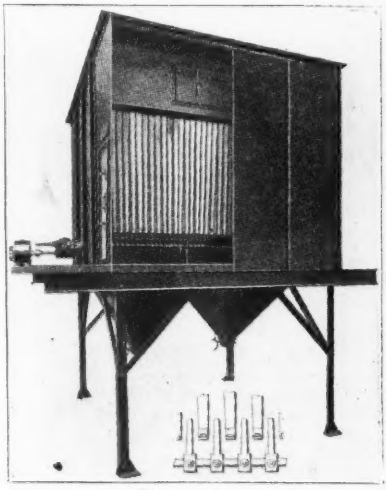


Figure 5.

spill that is not cared for by the suction hood. The dust is reclaimed by collectors of the filter type which also care for the dust from the bag cleaning wheels that are a part of up-to-date installations.

The general arrangement of the packer and collector is shown in Fig. 7, in which the hood attached to the packer and the pipe from it to the collector are clearly shown. A pipe from the supply bin is also indicated, and this serves to take care of the dust that would otherwise arise when cement is being discharged into the bin from a conveyor or elevator.

Figure 8 (9) shows how clean a packing room may be kept while in operation. This photograph was taken in the cement plant of the Ford Motor Co., at Detroit, and this con-

(7) W. W. Sly Manufacturing Company, Cleveland, Ohio.
(9) W. W. Sly Manufacturing Company, Cleveland, Ohio.

cern is known to demand as near 100 per cent performance as they can get. The packer was shut down momentarily while the picture was taken, but the condition of the air in the room is the same as when running. Only those who have worked in some of the older shipping department can appreciate the change for the better that dust collectors have brought about.

In conclusion, there are one or two points that should be considered by those contemplating dust collector installations.

First, due regard should be given to the cutting effect of the dust particles traveling at high velocity through the ducts. This is particularly noticeable at elbows and other places where the pipe changes direction, and the seriousness of the trouble depends on the nature of the dust being handled. It is not important with raw material dust, except perhaps where slag is used, because ordinary limestone and clay or shale are not markedly abrasive. Cement dust is another matter. Bends in the dust piping back of Bates packers have been cut through in six weeks, and the straight pipe failed later. The air velocity must be kept high enough to carry along the largest pieces that will be picked up. The coarser particles of cement are very hard and gritty, and the effect on the pipe is that of a sand blast. The pipe, and especially the elbows and bends should be made of much heavier material than would at first seem necessary, and the bends could well be reinforced along the outer side.

Second, the gases from dryers are always heavily laden with moisture and are sometimes saturated with it. In cold weather they will precipitate water on almost everything they touch. They can be treated in cyclones kept at a temperature above the dew point of the gas, and if complete purification is desired, the last step may be a water spray, the collected mud being discarded. In the case of coal dryers the same arrangement can be used, but it must always be remembered that a cyclone handling dry coal dust is a potential source of spontaneous combustion and explosion. The safest way is to pass the dust directly into a water spray.

Third—In collecting dust from a raw grinding department due regard should be had to the water vapor present. The rock and clay or shale are never perfectly dried, and much of the residual moisture is set free when they are pulverized. The moisture and dust-laden air may be treated in a heated cyclone, just as dryer gases are handled; but as the system

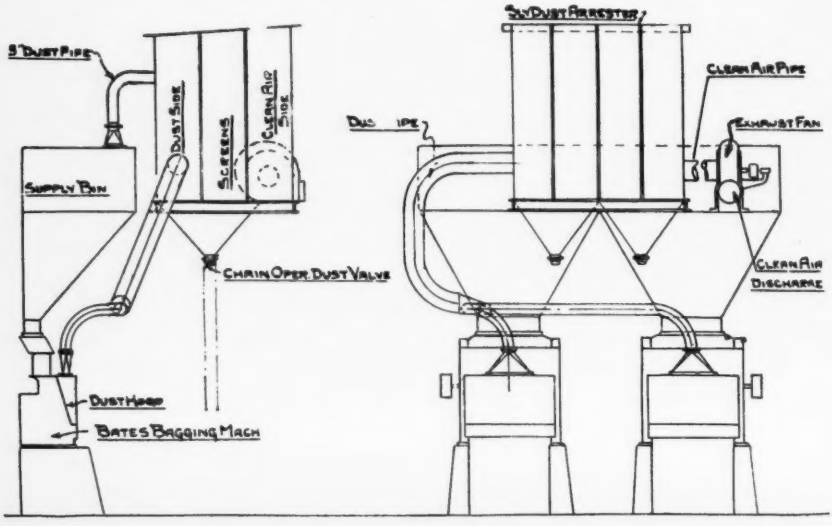


Figure 7.

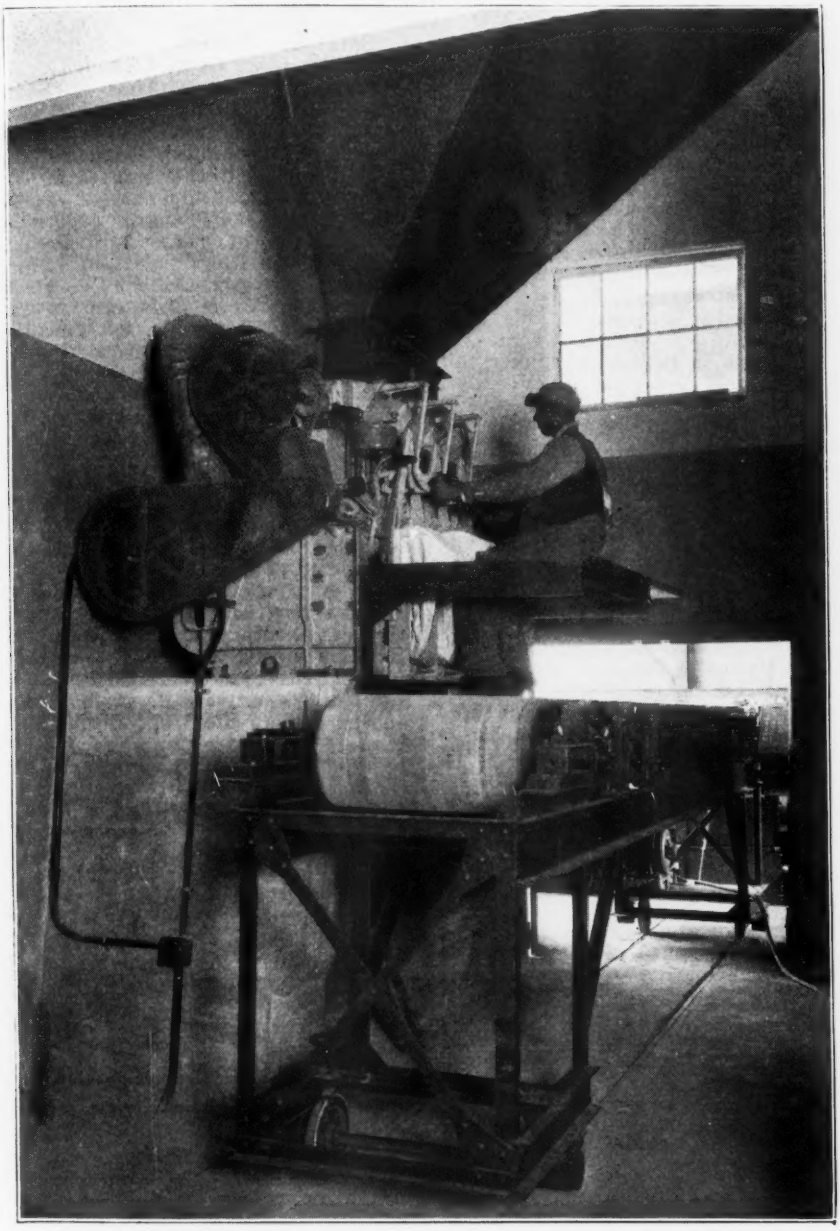


Figure 8.

may involve several suction pipes of varying lengths, it may be necessary to keep them warm also by covering them with heat-insulated material or by enclosing them in a box or jacket with a steam pipe.

Fourth, in many mills the clinker is more or less damp when ground. This may be due to the sprinkling it received when it came from the kilns or it may have taken up water in an outside storage. Whatever the source,

the dust arising during grinding will carry a good deal of vapor which will, especially in cold weather, condense as it cools. The cement dust that settles with it will then set to a hard mass. If such dust is passed through an air filter, there is danger that the cloth screens will become coated with set cement and their value permanently destroyed. This could be prevented by keeping the dust air at all times well above its dew point, and to insure freedom from condensation, all dust pipes and the case of the filter should be kept at this same temperature or higher. This is a vital point in collecting clinker mill dust.

Fifth, it may seem desirable to collect the dust from several widely separated points in a department, involving long gathering pipes. The air velocity in these must be high enough to prevent settling, otherwise choking will eventually occur. As before mentioned, condensation in these pipes must also be guarded against.

Sixth, when a dust collector is in use it would seem that vacuum sweeping is logically the next step, for it will do far more efficient cleaning than brooms. If the collector does not produce sufficient suction to do good sweeping a small high speed fan could be used for this purpose only, discharging its dust into the collector. The only other apparatus needed would be the piping and hose and a fan-shaped suction nozzle like that supplied with many vacuum cleaners.

Dust collecting in cement mills is only in its infancy, and while it offers some difficult problems, our engineers can work out a complete solution just as they have in so many other cases. It is the writer's belief that in a very few years the manufacture of cement will be just as clean as any other of our major industries.

The Hubbard Steel Foundry of East Chicago, Illinois, has completed the building of a new machine shop. This shop is equipped with the most modern machinery to machine all sizes of castings. The shop will be in operation early this month. This increase in facilities will make it possible to give prompt service to the non-metallic industries.

New Incorporations

Sarasota Cement Products Co., Sarasota, Fla. Capital $50,000. J. F. Baumgartner, R. P. Thacker, Sarasota, Fla.

Mohawk Limestone Products Co., Dover, Del., capital, $100,000; to deal in oils and other minerals.

Madison Sand and Gravel Corp., Hamilton, N. J., 750 shares, $100 each, 750 common, no par. R. E. Brooks, H. O. Whitnall.

Witty Improved Cement Co. Capital $50,000; to deal in cement and its products. George Witty, Washington, D. C., Angelo F. Divets, Charles M. Divets, New York City.

Coast Gravel & Construction Co., of Marshfield and Reedsport, Ore., incorporated; announced by T. A. Sweeney.

The Northwest Lime Co., of Seattle, Wash., has purchased lime deposits on Orcas Island and will construct a plant there. Officers: Lawrence Keefe, president, Charles E. Glendenny, vice president and general manager; D. L. Evans, vice president; Charles H. Graves, secretary and treasurer; and Dr. Charles W. Littlefield, trustee.

The British Columbia Gypsum Co., Ltd., of Vancouver, B. C., has purchased a fine waterfront site at Port Mann. A large gypsum plant is to be built here. The management has decided it will be more advantageous and economical to bring the rock down to tidewater, grind it there and ship the product direct.

The Moran Company, of San Francisco, California, which recently bought several hundred acres in Greenbrae, Marin County, will soon open a quarry there and install an endless cable for the transportation of cars from quarry to water line.

Roy Nelson Opens Office

Roy M. Nelson & Co. have opened offices at 53 W. Jackson Blvd., Chicago, with a high grade line of contractors', quarry and gravel plant machinery, consisting of mixers, conveyors, loaders, buckets, concrete carts, industrial and quarry cars, track, new and relayer rails, switches, air compressors and pumps, both diaphragm and centrifugals.

They are also representing Chas. Hvass & Co., New York, on their line of asphalt distributors, flushers, heating kettles, sweepers and road tools.

An Efficient Material Handling Layout

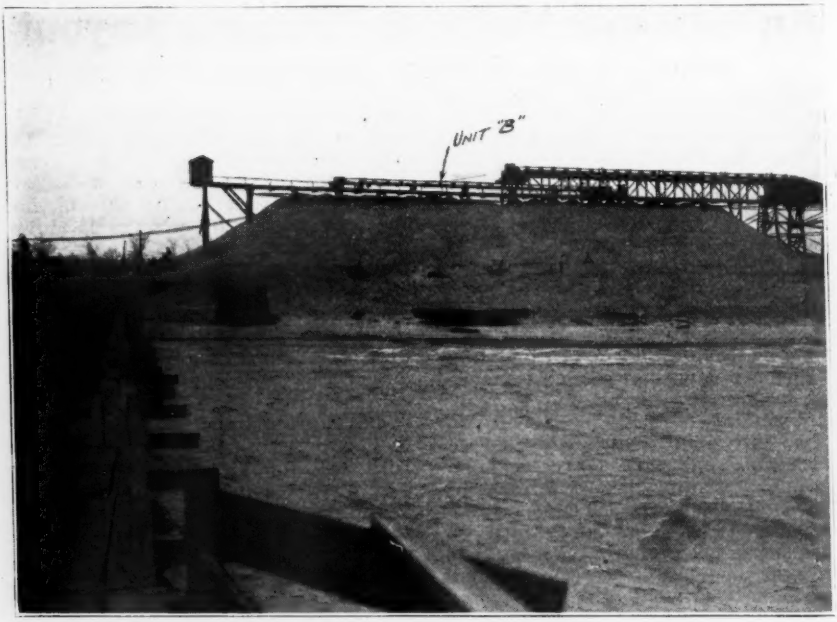
Written Expressly For Pit and Quarry By E. P. Escher

ABOUT four miles west of the town of Port Austin, the plant of the Port Crescent Sand and Fuel Company is located at Port Crescent, Michigan. The company has approximately a thousand acres of very high grade core sand. The bank runs from eighteen to twenty-two feet deep above the water line and is covered with only a very light layer of sod and clay which is stripped off before the digging operation. The operation of digging, conveying, storing, reclaiming and loading to ships is interesting.

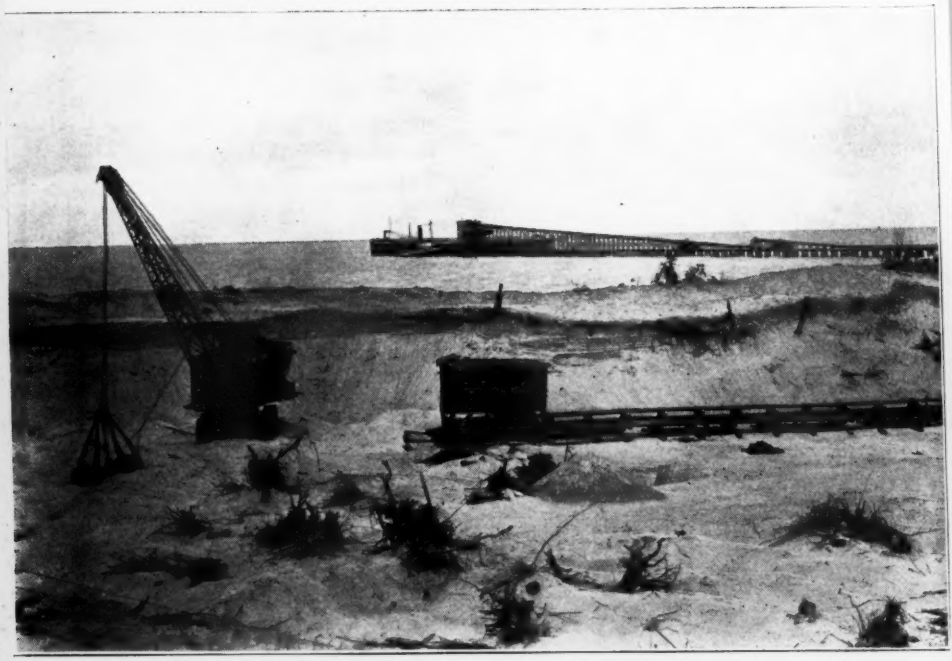
Two gasoline driven, Northwest, caterpillar type cranes are used for digging. These cranes work into the bank and discharge each to a separate traveling hopper mounted on a traveling field conveyor. This field conveyor is 350 feet centers and travels on a series of rails mounted on timbers. This belt conveyor, Unit "L," is arranged so that the above shovels, in making a 90 degree swing and traveling the length of the conveyor, cut one day's supply. At the end of the day the rails under the belt conveyor are moved ahead, and the conveyor is brought up again close to the shovels. By this method the traveling field conveyor is moved on its rails only once a day. This belt conveyor discharges to a belt conveyor, Unit "K," 1500 feet centers. The long belt conveyor is located in a cut down through the pit, and the first belt conveyor, Unit "L," will travel the full length on the north side of Unit "K," then will travel radially around the end of Unit "K," then will travel on the south side of Unit "K," its full length. This method always keeps the two cranes ahead of the traveling conveyor in a digging position. This operation will cover the season's run of the plant which will be from 600,000 to 800,000 tons.

The long belt conveyor, Unit "K," discharges to a belt conveyor, Unit "H," 400 feet centers which in turn discharges to an incline belt conveyor, 330 feet centers, Unit "A." This

View Showing Dock Loading Facilities

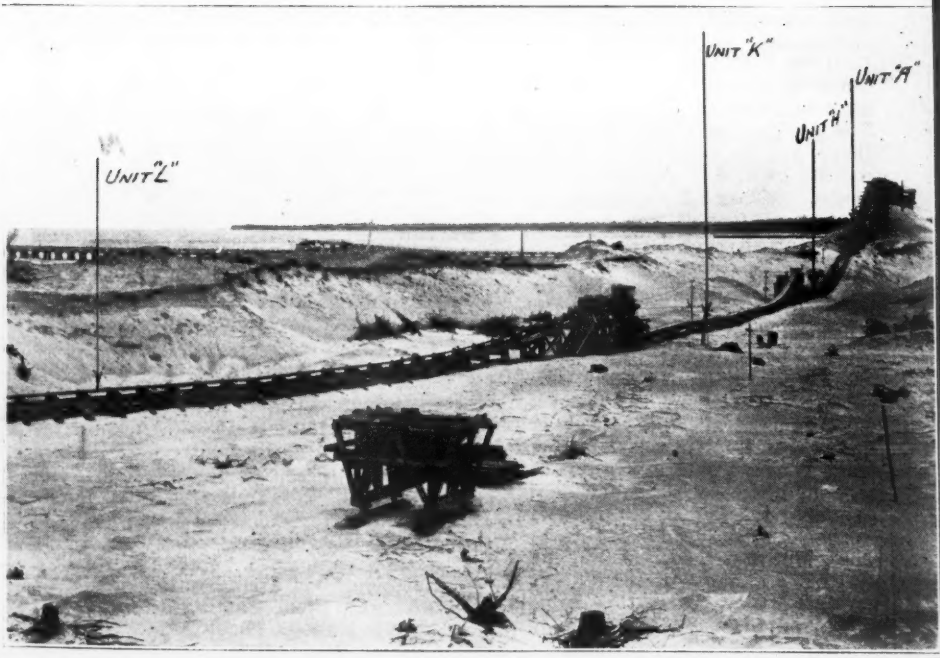


Storage Pile From Which Tunnel Conveyors Reclaim Material



Left Half of Panoramic View Showing Complete Plant Layout

Belt Conveyor From Storage To Loading Dock



Right Half of Panoramic View Showing Complete Plant Layout

belt conveyor elevates the material approximately 40 feet. It is then discharged to a traveling shuttle conveyor, Unit "B," 100 feet centers. By means of this shuttle conveyor, a storage pile, approximately 40 feet high and 250 feet long, containing 10,000 tons is obtained. This part of the plant operates continuously except when the entire storage is filled. On account of the fact that quick discharge to boats is necessary, it was found advisable to provide this large storage supply which is ample to take care of any ship which may come to the loading dock.

The storage referred to above is located directly over two tunnel belt conveyors. These belt conveyors reclaim the sand from storage and discharge it to two hoppers located at the east end of the storage pile. These hoppers are supplied with feeders, both of which discharge simultaneously to the first dock conveyor, Unit "D." This dock conveyor is 600 feet centers and discharges directly to the second dock conveyor, Unit "E," also 600 feet centers. Dock conveyor "E" discharges to the third dock conveyor, Unit "F," which is 600 feet centers and an incline. The discharging end is approximately 36 feet above the dock. This belt conveyor Unit "F," discharges to a shuttle conveyor, Unit "G," 40 feet centers, which extends to either side of the loading dock and discharges sand to the ships. The dock extends 1800 feet from the shore line in order that deep water will be available for the large ships loaded. They have approximately twenty-one feet of water at the loading point on this dock. The storing capacity is approximately 400 tons per hour. The reclaiming or boat loading capacity is approximately 700 tons per hour.

All the conveyors are 30 inches wide, gradual trough belts operating on unit ball bearing carriers. Stephens-Adamson special rubber conveying belt is used throughout. All the long conveyors are equipped with tandem drives with silent chains to the motors. The dock conveyors are equipped with 60 and 75 H.P. motors. The plant was designed and installed by the Stephens-Adamson Manufacturing Company of Aurora Illinois.

The Port Crescent Sand and Fuel Company has a very ready market for this product. It is delivered by ships taking cargoes of from 4000 to 8000 tons to any of the lake ports, principally Detroit, Toledo, Cleveland and Buffalo. The officers of the company are Max B. McFee, President and General Manager; Frank W. Pearson, Vice President; G. F. Wall, Secretary; and A. N. Farmer, Treasurer.

Asphalt and Related Bitumens in 1924

According to a statement issued by the Department of the Interior, based on figures compiled in the Geological Survey, asphalt and related bitumens produced in the United States in 1924 increased in both quantity and value. The sales of native asphalt and related bitumens were 570,000 short tons, valued at $3,988,000. The sales of asphalt manufactured from domestic petroleum were 1,158,000 short tons, valued at $14,306,000; from foreign petroleum, 1,920,000 tons, valued at $21,711,000.

Electric Steel Founders Announce

Charles N. Ring, until recently works manager of the Allied Steel Castings Co., Harvey, Ill., has been appointed as Assistant Director of the Electrical Steel Founders' Research Group, succeeding W. J. Corbett, who recently resigned to become secretary-manager of the Steel Founders' Society of America.

Mr. Ring has had more than 15 years' experience in steel casting manufacture, following his education at Washington University and the University of Missouri. At various times, Mr. Ring was connected with the American Steel Foundries, the Commonwealth Steel Co., the Illinois Steel Co., the Laclede Steel Co., and the Ohio Steel Fdy. Co., prior to his connection with the Allied Steel Castings Co. Mr. Ring is active in affairs of the American Foundrymen's Association and the American Society for Testing Materials.

The Director of the Electric Steel Founders' Research Group is R. A. Bull, and the companies of which the Group is composed are: Fort Pitt Steel Casting Co., McKeesport, Pa.; Lebanon Steel Foundry, Lebanon, Pa.; Michigan Steel Casting Co., Detroit, Mich.; Nugent Steel Castings Co., Chicago, Ill.; and Sivyer Steel Casting Co., Milwaukee, Wis.

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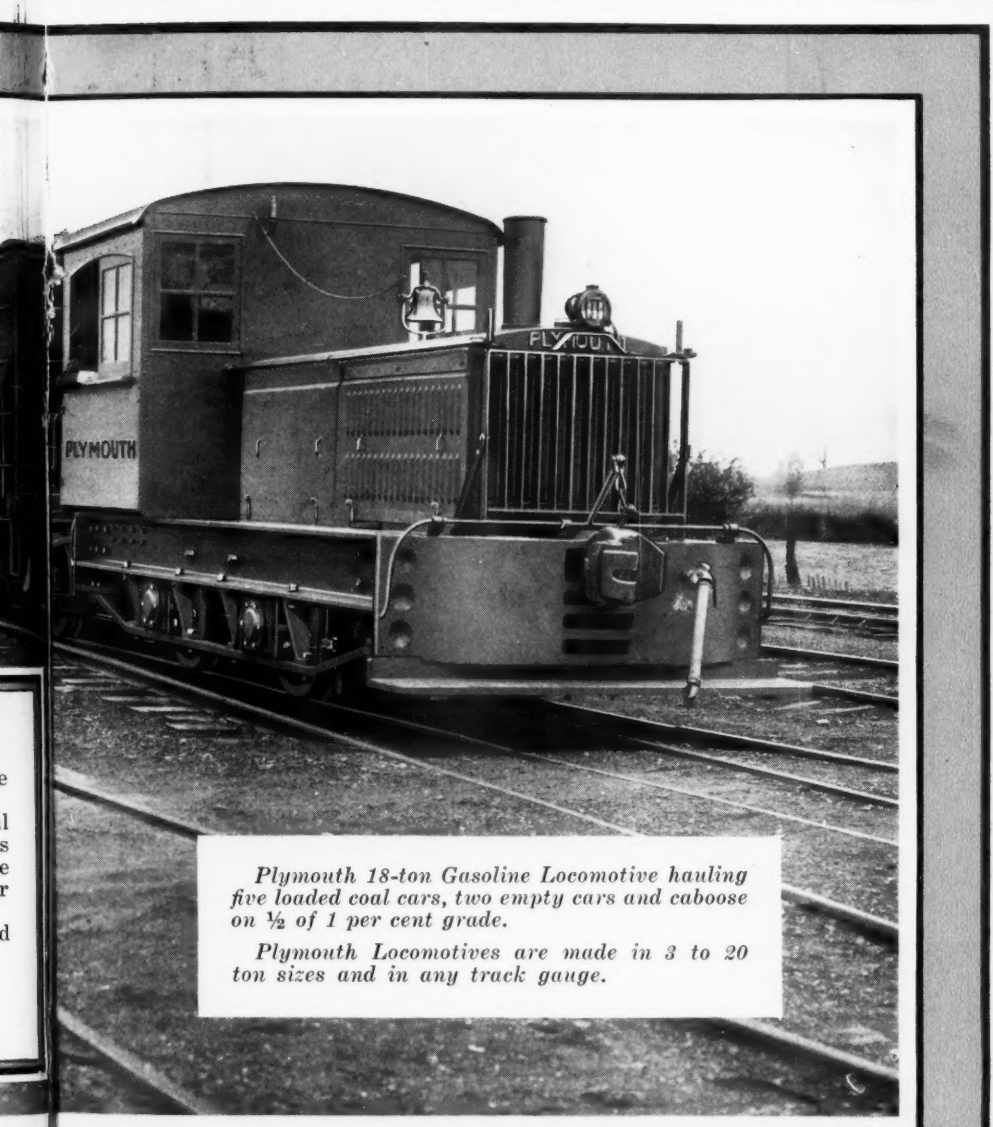
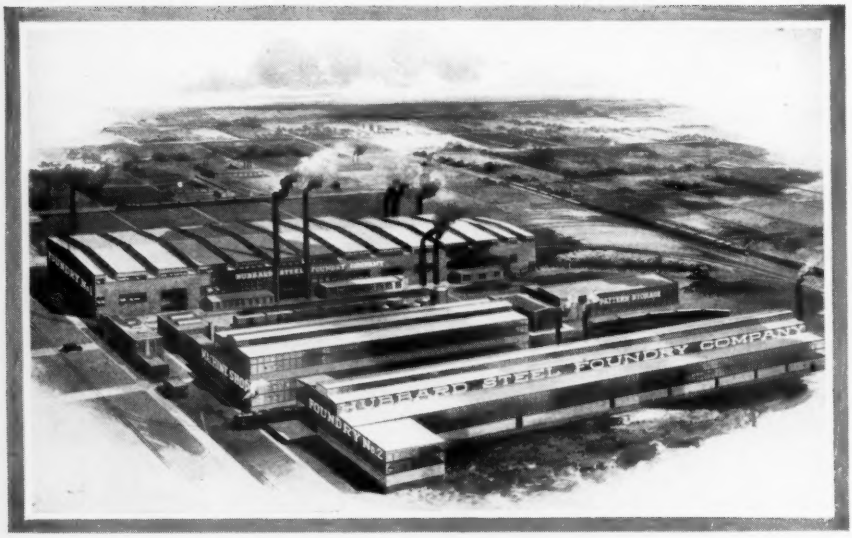


Plymouth 18-ton Gasoline Locomotive hauling five loaded coal cars, two empty cars and caboose on ½ of 1 per cent grade.

Plymouth Locomotives are made in 3 to 20 ton sizes and in any track gauge.

MOUTH
locomotives



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Do We Build To Burn?

By VIRGIL G. MARANI, C. E., M. Am. Soc. C. E.*

OF STRIKING interest to the general public is the January, 1925, issue of "Safeguarding America Against Fire," published by The National Board of Fire Underwriters, which lists in detail the amazing and preventable fire loss in the United States during 1923. Commenting on this national waste of materials and labor, under caption, "A New World's Title for America," the editorial states:

"World titles are no strangers to Americans. The soil of America seems fallow for their birth and the spirit of America favorable to their nurture. Only—among the concentration here of championships of the 'best' in this and the 'highest' in that, there are, unfortunately, a few 'worsts,' 'world worsts.' One of these is the national fire loss.

"Nowhere in that part of the universe known to be inhabited is there an amount of burning to be compared to that in America. This is a distinction, of course, but it is a wretched one, especially for a country which makes proud boasts of progress. Material progress is born of shrewd concern for the future; and what kind of thought for the future can it be that a people takes when it continues year after year literally to burn it up? In the last analysis all destruction by fire, whether it means the effacement of natural resources or of improved property, constitutes a burning not only of what is, but of what might be, in time to come."

The foregoing quoted matter is certainly food for sober thought especially since the statements, harsh as they may seem, are supported by the tabulations of the Actuarial Bureau of the National Board of Fire Underwriters which, for the year 1923, reports the value of fire consumed property at $535,372,782, an average of $1,466,775 daily or $1,019 a minute. Also the fire loss in America during 1903 was $145,302,155. This preventable waste has increased 269 per cent during a period of twenty years in spite of many commendable efforts to raise the standard of building construction through the enactment of laws and ordinances.

Accepting the fact that no substance will burn unless it is set on fire, it is safe to state that in a large majority of instances most of the annual fire waste is due to strictly preventable causes such as defective chimneys and flues, fireworks, etc., gas, open fires, ignition of hot grease and oils, etc., matches and smoking, open lights, petroleum and its products, rubbish and litter, sparks on roofs, steam and hot water pipes, stoves, furnaces and boilers. Of the fire losses reported for 1923, more than $29,000,000 was wasted, irrevocably lost, through the careless use of matches and smoking, and defective chimneys and flues were responsible for a fire waste loss of more than $20,000,000.

It is not necessary, for the purpose of this article, to list each of the preventable and partly preventable fire losses, but with an annual fire loss of considerably more than half a billion dollars, and the consequent tax levy to install and maintain adequate fire departments and fire fighting apparatus, a new world's title for America might be—"We Build to Burn."

Building code legislation throughout the states does not provide sufficient fire protection regulations for the non-fireproof (combustible) structure. In support of this statement attention is directed to the 1925 report of the National Fire Protection Association's Committee on Building Construction, which is a complete set of specifications for the residence class of buildings. It is safe to state that if the recommendations of this report, which are not impossible or prohibitive, were enforced as a part of the building regulations of every city, the fire loss, for the types of construction covered, would be reduced at least 75 per cent.

Considering types of building construction generally, and the commonly used materials intended to increase the fire resistance, there is no nonmetalic mineral substance that is making greater headway, and is more universally recognized as fit for the purposes intended, than gypsum. In the first place this mineral is extremely economical and abundant, being produced in eighteen of the United States, and Alaska, as well as being imported from Nova

*Chief Engineer, The Gypsum Industries.

Scotia, New Brunswick, and Ontario, Canada. At this time the annual consumption of gypsum for building purposes is more than four million tons. For various purposes and in different forms gypsum structural products are approved by the Underwriters' Laboratories, Inc. In view of the foregoing, and with due consideration of commonly accepted and prevailing types of construction that involve the use of gypsum in all or any one of the forms in which this product is marketed, the following will prove of interest.

1. In the Construction of Fireproof Buildings.

The essentials necessary in this type of construction are the use of materials, and combination of such, which will afford the greatest possible degree of fire resistance. Since the average temperature of a fire in a well filled structure has been found to be about 1700 degrees Fah., it will be readily seen that under such a degree of heat it is only a question of time until materials regarded as "fireproof" will be destroyed. In other words, and strictly speaking, there is no material or construction which is actually "fireproof" since high temperatures and time will destroy anything known to man.

The features aimed at in the assembling of materials for the fireproof (so called) building are:

(a) The thorough and complete protection from fire of any steel members used to carry loads.

(b) Floor construction of incombustible materials which will resist a time-temperature fire and water test for four hours. The test to be carried out in accordance with the specifications for such of the American Society for Testing Materials.

(c) Roof construction equal to the fire test requirements for floor construction or, in some cases, constructed of incombustible materials without regard to the degree of fire-resistance.

(d) The fire protection of steel columns and trusses for a period of two, three or four hours time-temperature fire and water test, depending on the use to which the building is put. The apartment house or hotel would require but a two hour fire test, while the storage warehouse should have the steel supports protected for a period of three or four hours.

(e) According to the use to which the building is put there should be well defined restrictions of floor area between fire walls.

(f) Dividing partitions should be of fire-resistive or incombustible materials. Between separate tenancies they should resist a time-temperature fire and water test for two hours.

(g) The walls of public corridors and similar horizontal exits should be of incombustible materials which will resist a time-temperature fire and water test for a period of two or three hours depending on the occupancy of the building. In the case of a theatre, hospital, asylum, and buildings of like character the fire test should be for the three hour period.

(h) Important vertical openings, such as stairway and elevator shafts, should be enclosed with construction of not less fire-resistive value than required for public corridors and similar horizontal exits.

(i) In the best fire-resistive (fireproof) construction, openings through fire walls, dividing partitions between separate tenancies, and the enclosures to vertical shafts, should be equipped with fire doors capable of resisting the standard fire and water test for a period of not less than one hour.

(j) Wainscoating, framing and trim of all doors and windows, as well as the doors, should be of metal in cases where the greatest possible fire resistance is desired. Wooden floors are often prohibited. Where woodwork is permitted it must be in close contact with the fire-resisting or incombustible material. Concealed air spaces must not be allowed where combustible materials are used.

In the foregoing, which outlines the high lights in fireproof (so called) construction, gypsum in any of its many forms will meet the requirements set forth, since the physical characteristics desired of any material from a fire-resistive point of view are:

That it must be incombustible and not support flame.

That it must resist the action of high temperature for a predetermined period.

That it must be a poor conductor of heat.

That is must have a low—almost immeasureable—total expansion when subjected to fire.

That it must not spall, warp or

buckle out of place when attacked by fire and drenched with water.

That it must be of such form and character as to be easily adapted to the purpose intended with due consideration to the equipment and labor necessary to execute the work.

Standard fire, water and strength tests, made by the Underwriters' Laboratories, Inc., and the fire testing station of Columbia University have demontsrated, beyond question of doubt, that for equal thickness gypsum will resist high temperatures for greater periods of time than any other commonly used fire resistive (fireproof) material. The destruction of gypsum from fire is due entirely to a slow calcination process which takes place during the period when the chemically combined (about 20 per cent by weight) water of crystallization is being liberated by heat. The tests referred to have shown that at a temperature of 2200 degrees Fah. it will take four hours to calcine the material to a depth of 3 1-3 inches. Also, at the end of this period (4 hours) the temperature of the gypsum, 3 inches back from the 2200 degree Fah. fire, was only 315 degrees Fah., and 6 inches back it was but 208 degrees Fah., or less than the temperature of boiling water. When we consider the effect of 2200 degrees of heat for four hours, and realize that 6 inches back from the face of the furnace only 9½ per cent of this temperature had penetrated, we have a complete answer to the superior low conductivity feature of this material.

The calcination of gypsum is a uniform and slow process and is not attended by undue expansion, warping, buckling and similar contributory causes of destruction. This is due to the fact that while calcination is taking place the water of hydration is being liberated in the form of steam, and for this reason the gypsum mass that is exposed to fire cannot attain a temperature that is appreciably higher than that of boiling water.

In fireproof (so called) construction, gypsum building products fulfill all the requirements as follows:

(1) Gypsum tile for furring and for non-bearing dividing and corridor partitions.

(2) Gypsum tile for non-bearing stairway and elevator enclosures.

(3) Gypsum tile for fire protection of steel columns, girders, beams and trusses.

(4) Gypsum tile for floor void fillers in reinforced concrete construction.

(5) Gypsum plaster board and gypsum plaster for suspended ceilings and non-bearing incombustible partition when secured to metal supports.

(6) Gypsum wall board, without plaster, for the finish of walls, partitions and ceilings in the interior of the building, when secured to metal supports.

(7) Reinforced gypsum for poured-in-place floors and roofs.

(8) Reinforced gypsum pre-cast tile or slabs for roofs.

2. Slow Burning Factory Construction

The term "slow burning factory construction" usually applies to what is known as "mill construction," a type of building which represents a splendid risk if in detail the recommended essentials are faithfully carried out. Buildings to be regarded as falling under this classification should conform to about the following general standard requirements:

(a) Masonry exterior walls and foundation.

(b) Masonry enclosing walls for stairway and elevator shafts.

(c) Timber columns for all floors (except top floor) to be of single piece and not less in area than 100 square inches. Top floor columns (supporting roof loads only) to be timber of not less in area than 64 square inches. All columns shall be a single piece.

(d) Floors shall be packed and not less than 4 inches thick, or matched or splined floors and roof decks not less than 2½ inches thick.

(e) Girders or beams supporting packed floors to be timber of not less area than 60 square inches. When supporting matched or spliced floors or decks they shall be timber of not less area than 48 square inches. All such timbers of less area than 160 square inches shall be a single piece.

(f) Rafters supporting roof loads only shall be a single piece of timber of not less area than 36 square inches.

(g) Concealed air spaces of any character are not allowed. Any fire protection material must be applied so as to follow the contour of the construction and be in contact with the surface protected.

A construction closely following the foregoing general requirements will usually afford better salvage values after the average fire than any other type of fireproof building, and this for the simple reason that heavy timbers will char rather than flame and there is no destruction from expansion, contraction, warping and buckling since wood is a poor conductor of heat.

It is hardly necessary to state that in a building of this character, gypsum products used for the fireproof structure can be used to equal advantage in this case. The most common application of gypsum in buildings of "mill construction" is for:

(1) Gypsum tile for furring and for non-bearing stairway and elevator enclosures.

(2) Gypsum plaster board and gypsum plaster for non-bearing incombustible partitions when secured to metal supports.

(3) Gypsum wall board, without plaster, for the finish of walls, partitions and ceilings in the interior of the building.

(4) Reinforced gypsum pre-cast tile or slabs for the roof.

3. Ordinary Construction Buildings

Since this type of construction involves exterior walls of masonry and interior floors, partitions and the roof of wood frame, it is unreasonable to require for buildings of this character a degree of fire protection without due consideration of the fire hazard which exists in the construction by reason of the combustible nature of the interior. The best that can be done to reduce the conflagration loss possible is to require certain refinements in methods of construction which, taken collectively, will retard the progress of fire for a sufficient period to assure the occupants a safe exit. From usual interior fire hazards an appreciable degree of fire protection can be obtained by:

(a) Firestopping the hollow partitions for 18 inches at the floor and ceiling levels.

(b) Intermediate firestopping at joists between ceiling and floor.

(c) Firestopping between joists and rafters at wall bearings and at furring on exterior masonry walls.

(d) Plastering all ceilings, including those of the basement and attic, upon incombustible lath.

(e) By interposing a layer of incombustible material between the rough and finish floors and between the roof boards and wood shingles or other combustible wood covering.

Gypsum products are particularly adaptable to the foregoing simple requirements. They are successfully used in the following:

(1) For all firestopping purposes by being poured in place in a plastic state or by cutting (sawing) gypsum tile or gypsum plaster board to fit and nailing in place.

(2) Gypsum plaster board ⅜ inch or ¼ inch thick is used between floors or over the roof boards and under wood shingles.

(3) Gypsum plaster wherever used, and especially upon incombustible lath such as gypsum plaster board, affords a degree of fire protection not possible with any other known plaster and lath.

4. Wood Frame Construction Buildings

This type of construction is particularly dangerous when considering fire from exterior or interior sources. The greatest loss, due to the nation's annual fire waste of more than $500,000,000 is carried by wood frame construction. As in the case of buildings of ordinary construction, the progress of fire can be materially retarded by efficient firestopping of all hollow wall spaces including, in this case, the exterior walls.

While firestopping is the most important item to consider in ordinary and wood frame buildings, no really scientific thought has been given toward methods and materials, used for this purpose, which can be easily applied at a minimum cost and which would assure the desired results. Blocking of incombustible material is being used, but improper fitting, poor nailing and the shrinkage of the wood construction results in leakage which reduces the efficiency of the firestop. Metal lath baskets fitted in place and filled with loose incombustible material are better in theory, but the cost discourages faithful compliance.

A recently developed gypsum product, in the nature of porous or puffed gypsum, has done wonders toward making the firestopping and insulation of buildings a simple and economical matter as well as a practical success. This material is shipped to the job in 80 pound paper bags,

is mixed with water and poured in place. According to the purpose intended this product is shipped so that after mixing, the material in place will weigh from 12 pounds to 30 pounds per cubic foot, the lighter substance being used solely for insulation, and for fire protection purposes when held in place by the construction. The 24 pound material is used for floor and roof fill while the 30 pound lends itself to making of structural units such as tile, etc.

The principle involved in the manufacture of porous or puffed gypsum is the introduction, in varying proportions, of chemicals into the calcined gypsum powder. When stirred into water the mixture becomes active, and a chemical reaction takes place releasing carbon dioxide gas and leaving a gypsum mass which sets hard in place and contains millions of minute air cells. The weight per cubic foot of the set and hard material depends on the quantity of dry chemical originally introduced into the gypsum prior to shipment.

The commercially valuable feature lies in the fact that the chemical action which causes the formation of air cells also increases by many times the original bulk with resultant corresponding reduction in weight per cubic foot. The incombustible and fire resisting properties of the predominating cementitious material (gypsum) are not impaired but rather are improved owing to the increase of non-conducting individual air cells. This feature will also improve the acoustic properties. This product is used in fireproof and other building construction for the following purposes:

(1) Poured-in-place or in the form of pre-cast units for non-bearing furring, partitions, shaft enclosures and for the fire protection of metal supports.

(2) Poured-in-place on top of reinforced concrete and clay tile roofs and floors for insulation and sound deadening.

(3) Poured-in-place or in the form of pre-cast units for insulating exterior walls of masonry.

(4) Poured-in-place or in the form of pre-cast units to fill the hollow space between wood stud supports for fire protection and insulation.

(5) Poured-in-place to fill to desired thickness, space between wood ceiling joists and rafters for fire protection, insulation and sound deadening.

(6) Poured-in-place fill of any character for firestopping and for any purpose where increased fire protection and insulation is desired.

There are other valuable uses of gypsum and the adaptability of this stance of this article is sufficient to illustrate the elastic possibilities of gypsum and the adaptibility of this valuable, economical and easily procured mineral to present accepted methods and types of construction.

Falk Speed Reducers

A handsome new catalog describing Falk Small Herringbone Gear Speed Reducers, printed in gray and blue, has just been issued by The Falk Corporation of Milwaukee, Wis. It is finely illustrated with photographs of units and installations, blue print drawings and Dimension Tables for Standard Units.

"Conveying and elevating machinery is manufactured in many types to meet the varied requirements of different industries," says the Introduction. "It is characteristic of this class of machinery that it must be operated by the application of power, usually in the form necessary to rotate a shaft at a definite speed and load.

"High mechanical efficiency, long life and uninterrupted service without attention are features that seem to have been overlooked.

"The demand for mechanical speed reducers has become so large that many types have been placed on the market. The fundamental idea which has governed the design of most of these devices is that something *compact* and *cheap* is ncessary. A speed reducer of this class may be capable of carrying a certain load with safety provided that load is intermittent, with time to cool off in the intervals, but if used for *continuous* service, a larger and more expensive size must be chosen, with the result that mechanical efficiency is *further reduced* by the use of an oversize unit.

"The Falk Herringbone Speed Reducers have been designed to meet the requirements of those industries which need *continuous* service over long periods of time."

Points of advantage are cited under Adaptability, Capacity, Construction, Dependability, High Efficiency, Lubrication and Quietness.

Portland Cement Output in May, 1925

The following tables, prepared under the direction of Ernest F. Burchard, of the Department of the Interior, Geological Survey, are based mainly on the reports of producers of Portland cement. The May, 1925, totals include estimates for three plants. Production for the month is the greatest on record, shipments are the highest yet recorded for any May, and have been exceeded only in three other months, and stocks are over 13 per cent higher than in May, 1924.

Production, shipments, and stocks of finished Portland cement, by districts, in May, 1924 and 1925, and stocks in April, 1925 in barrels.

Commercial District	Production May		Shipments May		Stocks at end of May		Stocks at end of April 1925a
	1924	1925	1924	1925	1924	1925	
Eastern Pa. N. J. & Md..	3,463,000	3,660,000	3,690,000	4,125,000	4,165,000	4,106,000	4,571,000
New York.....	685,000	838,000	747,000	907,000	1,238,000	1,164,000	1,232,000
Ohio, Western Pa. & W. Va..	1,201,000	1,540,000	1,237,000	1,590,000	1,883,000	1,966,000	2,017,000
Michigan.....	877,000	1,120,000	1,010,000	1,201,000	765,000	1,246,000	1,326,000
Wis. b, Ill., Ind. & Ky....	1,960,000	2,400,000	2,133,000	2,586,000	2,524,000	3,369,000	3,555,000
Va., Tenn., Ala. & Ga....	985,000	1,162,000	996,000	1,233,000	771,000	611,000	683,000
Eastern Mo., Ia., Minn. & S. Dak. c.....	1,481,000	1,552,000	1,509,000	1,714,000	2,491,000	3,138,000	3,300,000
Western Mo., Neb., Kan. & Okla.....	1,053,000	1,130,000	1,081,000	1,169,000	1,096,000	1,558,000	1,596,000
Texas.....	412,000	392,000	440,000	429,000	308,000	258,000	294,000
Colo. & Utah..	267,000	265,000	279,000	227,000	183,000	350,000	312,000
Calif.....	1,069,000	1,067,000	1,106,000	1,130,000	382,000	456,000	520,000
Ore., Wash., & Mont.....	324,000	377,000	323,000	424,000	597,000	424,000	471,000
	13,777,000	15,503,000	14,551,000	16,735,000	16,403,000	18,646,000	19,877,000

a Revised. b Began producing and shipping June, 1924. c Began producing December, 1924, and shipping January, 1925.

Stocks of clinker, or unground cement, at the mills at the end of May 1925, amounted to about 8,892,000 barrels compared with 9,731,000 barrels (revised) at the beginning of the month.

Production, shipments, and stocks of finished Portland cement, by months, in 1924 and 1925, in barrels.

Month	Production		Shipments		Stocks at end of month	
	1924	1925	1924	1925	1924	1925
January.....	8,788,000	8,856,000	5,210,000	5,162,000	14,155,000	17,656,000
February.....	8,588,000	8,255,000	5,933,000	6,015,000	16,815,000	19,689,000
March.....	10,370,000	11,034,000	8,995,000	10,279,000	18,189,000	20,469,000
1st quarter.....	27,746,000	28,145,000	20,138,000	21,456,000	.....	.....
April.....	11,726,000	13,807,000	12,771,000	14,394,000	17,159,000 a	19,877,000
May.....	13,777,000	15,503,000	14,551,000	16,735,000	16,403,000	18,646,000
June.....	13,538,000	.....	15,036,000	.....	14,903,000	.....
2nd quarter.....	39,041,000	.....	42,358,000	.....	.....	.....
July.....	14,029,000	.....	16,614,000	.....	12,319,000	.....
August.....	15,128,000	.....	16,855,000	.....	10,666,000	.....
September.....	14,519,000	.....	16,827,000	.....	8,404,000	.....
3rd quarter.....	43,676,000	.....	50,296,000	.....	.....	.....
October.....	14,820,000	.....	17,160,000	.....	6,073,000	.....
November.....	13,141,000	.....	10,289,000	.....	8,928,000	.....
December.....	10,435,000	.....	5,506,000	.....	13,913,000	.....
4th quarter.....	38,396,000	.....	32,955,000	.....	.....	.....
	148,859,000	.....	145,747,000	.....	.....	.....

a Revised.

Lime in Asphalt*

By PREVOST HUBBARD, Chief Engineer of The Asphalt Association

ASPHALT pavements consist for the most part of mixtures of coarse mineral aggregate such as broken stone, sand or combinations of the two with a finely divided mineral filler and asphalt cement. During 1924 about 118,000,000 square yards equal to 11,200 miles of asphalt pavement with an average width of 18 feet were laid in this country. About 12,000,000 square yards were maintained by replacement of worn out asphalt pavements giving a grand total of 130,000,000 square yards. This work involved the use of about 1,300,000 tons of asphalt and probably somewhat more than the same amount of mineral filler. I believe, therefore, that it is safe to assume that our present annual consumption of mineral filler in asphalt pavement construction and maintenance is not less than 1,300,000 tons.

The type of mineral filler most commonly used is limestone dust although Portland cement is also employed to some extent for the same purpose. In addition, slate dust, silica and a number of other products are used to a very limited extent. The part played by mineral filler in an asphalt pavement is first, to fill the voids between the grains of coarse mineral aggregate which is the predominating constituent of the mixture. The filler must therefore be very finely divided, and it is customary to class as true filler only that portion of the commercial product which will pass a sieve with 200 openings to the linear inch. In addition to filling voids, mineral filler also serves to stiffen or toughen the mixture in which it is incorporated.

In the sheet asphalt pavement which is perhaps more extensively laid than any other type of asphalt pavement, mineral filler is used to the extent of about 15 per cent by weight of the total mix while the average percentage of asphalt amounts to a little over 10 per cent.

In preparing the mixture the mineral aggregate and asphalt are first heated and then dumped into a batch mixer usually of the pug mill type where they are mixed for a period of approximately one minute or until all particles of coarse mineral aggregate and filler are thoroughly and uniformly coated with asphalt. This operation is conducted at a paving plant usually located some distance from the pavement which is being laid.

The hot mixture is loaded into trucks and hauled to the site where work is in progress, and is dumped upon the prepared foundation and spread and raked in a uniform layer of suitable thickness. While still hot it is then compressed by means of a heavy road roller after which the surface is finished off with a light sweeping of mineral filler to give a pleasing uniform color. This type of pavement is familiar both on country roads and on city streets and is considered one of the most nearly ideal for all classes of traffic.

The enormous increase in highway traffic during the last few years subjects the average pavement to much more severe service conditions than were formerly encountered. To meet these conditions successfully it is desirable to increase the stability of the asphalt paving mixture as much as possible so that it will not deform or push into waves and bumps under the continuous passage of vehicles. Highway engineers know that the stability of the paving mixture depends upon a number of factors including the grading of the mineral aggregate or sizing of particles, the per cent and character of asphalt used as a binding material, the percentage and character of filler which is used and the degree of compression of the hot mixture which is obtained during construction. Until recently, however, we have had no practical means of quickly determining the relative stability of various combinations of mineral aggregate filler and asphalt prior to their use in pavement construction and the Association which I represent has therefore been very much interested in developing a simple laboratory test which would enable us to study paving mixtures from the standpoint of their stability value. We have devised a test for this purpose which promises to be of considerable value, and the results of

*A paper presented at the Seventh Annual Convention of the National Lime Association held at Briarcliff Manor, New York, May 26, 27, 28, 29, 1925.

our investigations to date have indicated that next to initial compression, the per cent and character of mineral filler are the most important factors controlling stability of the mixture.

As previously stated most of the mineral filler so far used has been limestone dust, but it is by means certain that this product is the best material to use. We have therefore been interested in comparing the stabilizing value of commercial limestone dust with other commerical products which might be suitable for use. Because of its extreme fineness and general availability in large quantities, hydrated lime naturally suggested itself as a material which might be well adapted for use as mineral filler, and we are now investigating this matter. It is well believed that the results which we have so far obtained from this investigation will be of interest, particularly in view of the possible tonnage involved in case the product ultimately proves satisfactory for the purpose.

The stability of asphalt paving mixtures is influenced by so many variable factors that in our earlier investigations we attempted to eliminate as many variables as possible so that we might provide a foundation upon which we could later build with some degree of assurance. We knew that stability would be considerably influenced not only by the consistency of asphalt cement but by the percentage used in the mix and by the temperature at which the test was made. We therefore decided to first eliminate this variable and to confine our studies as far as possible to the relative stability of various mineral aggregates including filler entirely apart from any binding medium. In order to do this, however, it was necessary to mix the mineral constituents with some fluid body which would bring the particles into intimate contact and prevent segregation in the test specimen. We finally found that castor oil would serve this purpose admirably as it possesses no adhesive properties and is sufficiently viscous to hold the particles together if mixed in suitable proportions. The apparatus which we employed to measure relative stability consisted of a cylindrical mold in which the mixture was compressed to form a briquette approximately 2 inches in diameter and 2 inches high. The test itself consisted in forcing the compressed mixture through a circular orifice 1½ inch in diameter and measuring the maximum load required to force the mixture past the orifice. This load was recorded as a measure of the stability of the aggregate. Sands of various mesh composition were tested in this manner and then mixtures of these sands with increasing amounts of limestone dust filler were also tested. It was found in every case that the addition of mineral filler produced a marked increase in stability of the mineral aggregate.

We then turned our attention to a study of the stabilizing value of different types of mineral filler, and for this purpose we selected limestone dust which could be considered as a relatively coarse product, Portland cement a filler of medium fineness and hydrated lime which is, of course, extremely fine.

We found that there was apparently but little difference between the values obtained with limestone dust and Portland cement but that commercial hydrated lime when used upon an equivalent weight basis with the other fillers produced considerably higher stability values.

In analyzing these results we came to the conclusion that, because of its lower specific gravity and greater fineness, a given weight of hydrated lime occupied a greater volume in the mixture than either limestone dust or Portland cement and we then determined by test that the volume equivalent of hydrated lime was approximately twice that of the other two fillers. Comparing the stabilizing values of the three fillers upon a volume equivalent basis brought the results somewhat closer together, but hydrated lime still continued to give higher values than the other two products. We came to the conclusion that, in addition to its greater volume, the extreme fineness of hydrated lime which produced a greater surface area of fine material increased the frictional resistance between the mineral particles in the mixture. We therefore sifted samples of each of the fillers so as to obtain material of the same degree of fineness passing a 200 mesh and retained upon a 350 mesh sieve and compared the stability values obtained from these prepared fillers. The results were found to be closer together, but hydrated lime still showed higher values.

The effect of the extremely fine portion of each filler was then studied by using samples which were first passed through the 350 mesh sieve. When mixtures prepared with these products were compared upon a volume equivalent basis, the results were found to lie much more closely together than in any other comparisons. Some differences exist, however, which are probably explainable by differences in surface texture of the particles of filler. It is believed that these comparisons have been helpful in explaining later results which we have obtained. From a theoretical standpoint volume equivalent comparisons are interesting, but as all fillers for paving work are purchased and used upon a weight basis, the true comparison of the stabilizing value of mineral fillers should also be made upon a weight basis taking into account their relative cost per unit of weight.

So far our results were interesting, but we realized that it was necessary to ascertain if the same general relations held good for mixtures in which asphalt was incorporated as a binding material and that in the case of hydrated lime which had been used to only a very limited extent in actual construction it would also be necessary to ascertain if the lime produced any injurious effect upon the asphalt itself. In order to study the mixtures containing asphalt we had to devise a special testing apparatus which, however, made use of the same principle as described for the test of mineral aggregates mixed with castor oil. The test which we have so far used for this purpose consists in making up 2 inch cylindrical briquettes of hot asphalt paving mixtures and allowing them to cool and age overnight. These briquettes are then placed in a water bath and brought to a temperature of 140 degrees F. after which they are tested in a cylindrical testing mold with a circular orifice at the bottom 1¾ inch in diameter and by means of a specially designed loading machine, the maximum load required to force the mixture through this orifice is recorded. Taking a given sand and using the same percentage of a given asphalt cement throughout, it was found that the addition of mineral filler increased the stability of the mixture as in the castor oil mixtures and that the relative stabilizing values of hydrated lime and limestone dust were also similar to the castor oil mixtures.

A large number of mixtures of sand, mineral filler and asphalt were then tested using varying percentages of asphalt and filler. From the results obtained the maximum stability values for given percentages of each filler were then obtained. When these results were compared with an equivalent weight basis it was found that hydrated lime when used up to the extent of 10 per cent gave stability values equivalent to twice the weight of limestone dust but that in general more asphalt was required to produce a satisfactory mixture. As an illustration, to obtain the maximum stability with a mineral aggregate containing 15 per cent hydrated lime, 14 per cent of asphalt was required; while to obtain the maximum stability from a mixture containing 20 per cent of limestone dust about 12 per cent of asphalt was required. This factor would of course have to be taken into consideration in actual construction work where hydrated lime is used and would involve a modification of present practice in proportioning the mixture.

As the primary use of a filler is to fill voids and make the mixture more dense, specific gravity or density determinations were made on all of the specimens subject to the stability test and the percentage of voids in the compressed mixture calculated from a knowledge of the specific gravities of the different constituents and the percentages in which they were used. It was ascertined that quite a definite relation existed between the voids in the mixture and the stability values shown by each test and that in general as voids decreased with the addition of filler, stability values increased. It was also found that with given percentages by weight of filler, hydrated lime produced mixtures with a lower percentage of voids than did limestone dust. Such mixtures should therefore be more impermeable and waterproof.

We have not carried our investigations sufficiently far at the present time to be able to state definitely that hydrated lime will prove to be an acceptable filler for use in asphalt paving mixtures, but certainly the results so far obtained in the laboratory appear quite favorable. The results should however be confirmed by additional tests covering a great number

of variables affecting stabilizing values both from the standpoint of composition of the mix and in connection with the preparation and manipulation of the mixture and the method of testing. In any event, laboratory tests alone should only be considered as indications of what might reasonably be expected in paving construction. Proof of the pudding lies in the demonstrated practicability of using hydrated lime in the preparation of commercial mixtures and in the service results under various traffic and climatic conditions eventually obtained from such mixtures. Difficulties in manipulation of the mixture at the plant may occur as well as difficulties in laying and compressing the mixture upon the street, it is, therefore, quite necessary to conduct field tests which will either prove or disprove the indications obtained from laboratory tests.

Arrangements are now being made to lay a number of experimental sections of sheet asphalt pavement in one of the southern states through a co-operative arrangement between your Association, the Asphalt Association and a southern contractor. The tentative layout of this work calls for the construction of sections of pavement not less than ¼ mile. Each will be subject to practically identical traffic conditions and a direct comparison will be obtained of the relative efficiency of limestone dust and hydrated lime when each is used to the extent of 7½ and 15 per cent by weight. We originally suggested that for mixtures containing equivalent percentages of the two fillers, the same percentage of asphalt be used, but in light of our most recent laboratory investigations, it would appear desirable to increase the percentage of asphalt in the mixtures containing hydrated lime.

I have touched upon only a few of the high points of our general investigation. There are a great many details of the work which I have not attempted to cover as I do not believe they would be of any great interest. We believe, however, that the results so far obtained are of considerable interest to both of our Associations and that the work already begun is well worth pushing to its ultimate conclusion. This will, however, require time with the somewhat limited facilities at present available.

Freight Car Loadings

Freight cars loaded with revenue freight during the week which ended on June 13, totaled 987,196 cars, according to reports filed by the carriers with the car service division of the American Railway Association.

Compared with the corresponding week last year, this was an increase of 84,604 cars, but a decrease of 21,642 cars under the corresponding week in 1923.

The total for the week of June 13 was a decrease of 7,678 cars under the preceding week, decreases being reported in the loading of all commodities except coal and miscellaneous freight.

Coal loading totaled 157,559 cars, an increase of 5,993 cars over the preceding week and 19,319 cars above the same week last year. Miscellaneous freight loading for the week of June 13 totaled 367,343 cars, an increase of 917 cars above the week before and 48,717 cars above the same week last year.

Grain and grain products loading amounted to 35,570 cars, a decrease of 2,222 cars under the week before and 2,143 cars below the same week last year.

Loading of merchandise and less than carload lot freight amounted to 256,682 cars, a decrease of 1,716 cars under the week before, but 15,025 above the corresponding week last year.

Ore loading totaled 61,323 cars, a decrease of 4,953 cars under the preceding week but 1,208 cars above the same week last year.

	1925	1924	1923
June 13	987,106	902,592	1,008,838
June 6	994,874	910,793	1,012,312
May 30	920,514	986,209	820,551
May 23	986,209	918,214	1,015,532
May 16	984,916	913,201	992,319
May 9	981,370	908,213	974,078
May 2	981,711	913,550	961,617
April 25	959,225	878,387	962,578
April 18	922,778	876,916	970,042
April 11	917,284	880,937	945,271
April 4	922,375	861,990	896,375
March 28	931,395	907,389	896,735
March 21	909,363	908,290	916,818
March 14	924,149	916,762	904,116
March 7	930,009	929,381	905,344
February 28	862,910	944,514	916,624
February 21	925,295	945,679	830,187
February 14	902,877	935,589	816,646
February 7	928,244	906,017	849,352
January 31	896,055	929,623	865,314
January 24	924,254	894,481	896,464
January 17	932,150	894,851	864,297
January 10	932,807	872,023	873,908
January 3	765,727	706,292	727,246

Blasting Practice in Quarry And Open Pit Mining

Written Expressly for Pit and Quarry, By R. N. Van Winkle*

Part III

This is the third of a series of six articles. The first appeared in the June first number of PIT AND QUARRY. In the first article Mr. Van Winkle discussed the action of explosives, kinds of explosives, selection of explosives and amount of explosives to use.

In the second article, which appeared in the June 15th number, the size of cartridges, explosive costs, and methods of figuring the shot were discussed.

Readers are invited to correspond with Mr. Van Winkle in relation to these articles or to blasting problems in general. The editor of PIT AND QUARRY will be pleased to receive comments or data on this subject from readers whose experience and knowledge will be of value in the study of blasting practice.

EDITOR

R. N. Van Winkle.

Drilling

Drilling operations and the proper location of drill holes is a most important thing. The method of drilling and the location and spacing of bore holes depend on the system of attack, which has been or should be previously and carefully planned. In drilling operations as well as in blasting operations what success you meet with tomorrow is dependent on what you do today. In bank shooting several methods or plans of drilling are used; single row method, either staggered or in line; two or more row method fired in one shot; blanket or buffer method; benching method; snake holing and the drilling of small diameter bore holes in between well drill holes but not down to the full depth. When the face or bank of stone especially is over 40 feet in height. the single row method of drilling and shooting is best. If, however, more than one row is to be carried, the burden imposed on the other rows of holes should be less than that imposed on the front or first row.

Where low faces or banks are carried, it is good policy to use what we have learned to call blanket or buffer shooting. This is especially true where the steam shovel method is used for loading after the ground is blasted. Blanket or buffer shooting is accomplished by shooting a second row of holes before the blasted material is cleaned up from the first shot. It is in reality shooting against a bank already blasted, which bank offers resistance and confinement, thereby gaining more efficiency for the dynamite or explosive used. This means better fragmentation.

It is a capital idea for the purpose of locating drill holes in bank method work, and moreover, as a matter of reference, to establish at a sufficient distance from the working face a straight and permanent base or reference line and to make all measurements and calculations thereafter from this line. Working faces of quarries in a great many instances, especially where no previously thought out plan of attack is followed, invariably become irregular and ragged. Taking measurements from working faces for locations of drill holes is bad practice and will unquestionably

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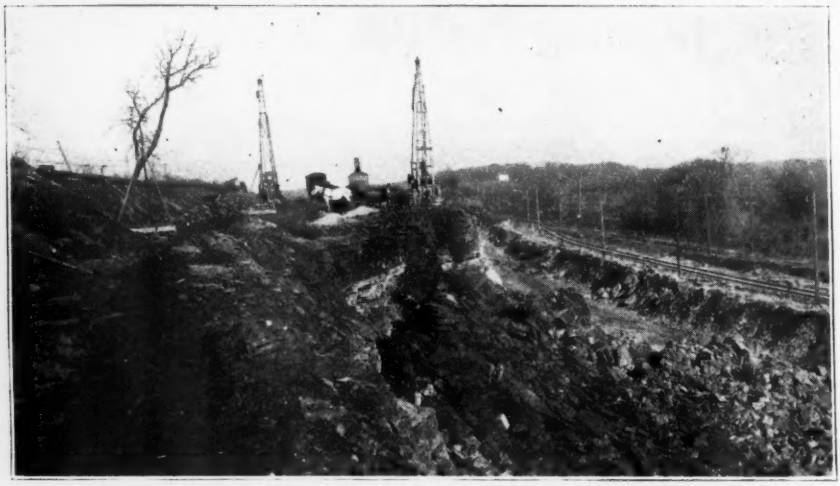
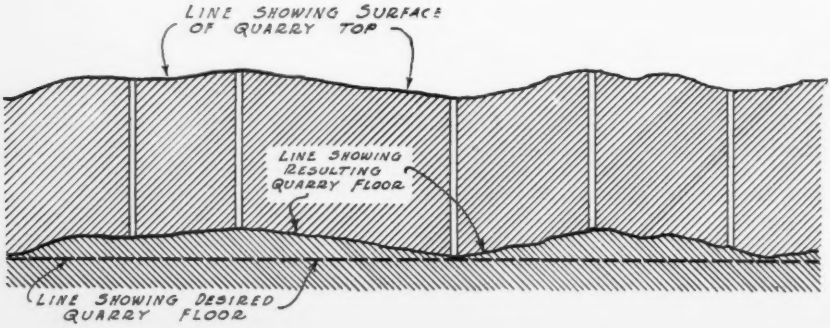


View Showing Irregularities of the Top of a Typical Quarry Face

cause serious trouble sooner or later. The practice of measuring back from the top of a quarry face for the location of drill holes is, in the writer's opinion, the primary cause of hard toe or unshot toe at the bottom of the bank. As long as this practice is followed, this toe will accumulate instead of diminish. The accompanying illustration gives a fair example of the irregularities of the top of a quarry face. It is obvious that it would be almost hopeless to attempt to take measurements from this face for the location of another row of drill or bore holes with any degree of accuracy.

While the well drill or churn drill method of drilling is being quite universally used in open pit operations, tripod and rotating jack hammer drills are doubtless more economical in drilling low faces for benching operations, or where stratification of ground is pitching, also for snake holing and for use in conjunction with well drill operations where small holes can be intermingled with the larger holes for greater fragmentation in top strata. For drilling operations in bank work tripod or rotating jack hammer drills reach their limit of efficiency at about 15 feet. The staggering of drill holes is an accepted practice and is highly beneficial in many operations.

Owing to the importance of drilling operations the work of the driller should not be taken for the depth of the finished hole, but an accurate check should be made. It can readily be seen that if drill holes are put down to irregular depths, the results will be irregular bottom and tight



bottom when the steam shovel gets into the bank loading.

Quite often no levels are established from which to measure the depth of drill holes assuming the top as level or relying on the eye to detect depressions or rises. When the top is assumed to be level when in reality it is not, the result from drilling all holes the same depth is shown in the following sketch. This sketch may be exaggerated, but it shows clearly that the irregularities in the top are reproduced on the floor causing no end of delay and inconvenience when loading with a steam shovel and resulting in a ragged uneven floor.

Drill or bore holes put down by any method should be straight and as smooth as possible. A great deal can be learned regarding the hardness and toughness of the ground, as an aid in figuring explosives required to break it properly, from the way the ground drills. Moreover, if a log is kept of each hole drilled giving the thickness of strata, seams, pockets, etc., it will be highly valuable in loading operations later on. Crooked holes are a menace in loading operations and should be avoided. Crooked bore holes made by well or churn drills are as a rule caused by drilling with too slack a line. The tricks in drilling, however, are by far too many to cover at this time.

Drilling operations for secondary blasting have come to depend entirely upon rotating jack hammer drills, air operated. These drills are almost indispensible today in open pit operations of any size. It is highly profitable to "hog over," that is to go over and plug drill for secondary shooting each bank shot as it is made. After the shot is made and spread out, plug drills can immediately be put to work plug drilling over-sized material which will greatly expedite loading operations at a later time.

Loading

The loading or actual operations of placing charges of explosives in drill or bore holes for firing or shooting is undoubtedly the most dangerous operation of blasting, and every safeguard known should be rigidly adhered to. The mere word, "dynamite," appears to have a peculiar effect on some people; it is something to be let alone and feared. It should, of course, be handled with good judgment. Most of the accidents which occur from the use of commercial high explosives are directly traceable, not to experienced, cautious powder men, but to fool-hardy, irresponsible, inexperienced men who are posing as shooters or blasters.

The first step prior to the actual loading of well drill or bore holes is to make a visual examination of the hole. This can be accomplished by standing directly over the hole and reflecting the sun's rays into the hole by means of a mirror or by the use of an electric pocket flash light. Not

Loading Well Drill or Bore Holes

only a visual inspection should be made, but the hole should be accurately measured for depth to see that it is down to proper depth and that no muck, water or foreign matter is in the bottom of the hole. This would prevent getting the explosive charge in the extreme bottom where it is most needed, and the failure to do this will cause accumulated toe and tight bottom. It is often necessary, owing to stones or other foreign matter dropping into a drill hole, to move back the well drill rig and clean out these holes. It is a practice to be encouraged. If heavy strata of rock or material occur in the ground to be shot, explosives should be located at these points by the method of stemming between the charges of explosives so that the work of the explosive will be done at the point most needed. This is sometimes referred to as breaking the charge of explosive and filling the intervening spaces with stemming.

Several methods are employed in lowering high explosives into deep well drill holes, but for holes as great as 30 or 40 feet deep cartridges can be dropped into position, provided the hole is not crooked or ragged, and provided the cartridge so nearly fills the hole as to cause an air cushion when dropped, thus preventing its striking with any degree of force. Otherwise use should be made of tongs, a wooden dart or wooden skewer. In well drill holes it is almost impractical to use a tamping stick as long as is required owing to its flexibility and the hazard of breaking it on account of its length. The general practice is to have a short tamping stick, possibly 6 or 8 feet in length and of the proper diameter for free action in the hole, attached to a rope of required length to reach the bottom of the hole. This tamping stick should be absolutely free from all metal and nails, and the rope should be woven into the top with no metal fasteners whatever. If added weight is required, the tamping stick can be reamed out and filled with lead, but this hole should be plugged up so as to eliminate any friction in the hole. There are occasions when a cartridge will become lodged in a hole, and this can readily be determined by accurately measuring the vertical distance each explosive charge and stemming takes up. Should this occur, a wooden stick can be procured, sharpened at one end, and gently rammed down through the cartridge splitting the paper covering, and in most instances the cartridge will drop to its position. In the absence of a stick long enough to reach the cartridge a sledge or pick handle can be sharpened and inserted into the end of a pipe. Due caution must be exercised not to let the pipe itself come in contact with the explosive, and as an added precaution water can be poured into the hole which will eliminate friction. In loading dynamite in bore holes, dynamite must be pressed firmly into place to avoid leaving any air spaces around the charge, as the air spaces will act as cushions cutting down the effectiveness of the explosive charge. Where electric exploders are used, exploders with proper lengths of wire should be chosen to reach entirely out of the collar of the hole, and allowance should be made for necessary splicing. Two exploders should be put in each primer cartridge and the wires securely tied around the cartridge which is lowered into the hole by means of the wires. After a priming cartridge with the exploders has been loaded into a well drill or bore hole, extra precautions should be taken in tamping owing to the sensitiveness of the exploders themselves and to the possibility of breaking the wires. With the aid of a tape line and proper forethought as to measurements, location of heavy strata, mud seams, crevices, faults, etc., there is absolutely no reason why the exact quantity of high explosives in pounds cannot be properly placed at the point where needed and desired. A good slogan not only for the loading of explosives in drill holes, but also for the handling, transportation and storage of explosive is, "Make haste slowly." Familiarity breeds contempt, and practically every accident that has occurred with commercial high explosives was due to disrespect, foolhardiness or lack of thought. It is good policy to handle high explosives cautiously. Enormous strides have been made in the successful manufacturing and transportation of high explosives, but there is always an element of chance in the use and handling of them. Just that time that one thinks there is no danger is the time when an accident occurs.

Too much consideration cannot be given to the proper distribution of explosives if effective results are to be expected. Bulletin 160, United States Bureau of Mines, shows the following table indicating the quantities of different classes of explosives that can be placed in each foot of bore hole of different sizes, provided the cartridges are slit and properly tamped.

Diameter of Drill Hole Inches	Gelatin Dynamite Lbs. per Ft.	Straight Nitro-glycerin Dynamite Lbs. per Ft.	L. F. Ammonia Dynamite Lbs. per Ft.
3	4.25	3.75	3.60
3½	5.68	5.10	4.89
4	7.55	6.60	6.33
4½	9.35	8.40	8.06
5	11.80	10.50	10.08
5⅝	14.94	13.20	12.53
6	17.00	15.00	14.40

In drill or bore holes of small diameter it is considered good judgment, if the ground will permit, to spring holes at the bottom forming a pocket or chamber to permit additional explosives. In springing operations the amount of explosives to be used is a matter of judgment or experience, but as a general thing it is safe to start with 1 to 3 cartridges of 1 inch to 1¼ inches diameter, 8 inches long, or larger, if holes will permit. Where holes are dry, it is advisable to wait an interval of 1 hour at least between the time of firing the first charge and the loading of the second charge in the same hole, or a long enough interval of time to be positive that the hole has cooled off, as a precaution against the new charge of explosive catching fire, and 1½ hours before the next operations. Where the holes are wet, the time can be cut down considerably. Each successive charge of explosive should be greater than the preceding one so that the explosive will rise higher in the hole, thereby enlarging the chamber or pocket. Rarely is it necessary to spring a hole more than five times.

Stemming is a prerequisite to efficient blasting, and results of tests made by the United States Bureau of Mines show that while stemming greatly increases the efficiency of black powder, ammonia and straight nitro-glycerin dynamites, and while a small quantity of stemming properly placed and tamped greatly increases the efficiency of dynamite, further additions of stemming do not increase efficiency proportionately. This is not true, however, with a slow burning explosive such as black powder. While again no absolute rule can be laid down for the amount of stemming to use, a safe rule is to use for stemming, if possible, 3 times the space occupied by the explosive charge, and at least 10 feet of well tamped stemming should be below the collar of well drill holes. It is fair to say that stemming increases explosive efficiency on an average of from 15 to 25 per cent.

In loading high explosives into bore holes for shooting it is necessary with the fuse or electric method of firing to use primers or primer cartridges, as they are doubtless better known. A primer cartridge is a cartridge of high explosives with 1 or more detonators of some kind inserted in it. These primer cartridges are made of dynamite where a large quantity of black powder is used as the explosive; but where only a small amount of black powder is used, no primer cartridge is necessary and cap and fuse will detonate the charge. In the shooting of dynamite the primer cartridge is sometimes made of a higher strength explosive than that used in the balance of the shot or bore hole, and is referred to quite often as a booster cartridge. In loading operations where the column of explosives is broken by stemming intervening a primer cartridge should be put in each and every explosive charge; but where the hole is loaded continuously with explosives, a primer every 10 to 15 feet is ample. In small diameter bore holes primer cartridges should be put in last or next to last, and one primer cartridge is all that is necessary. When firing electrically no less than 2 detonators should be placed in each primer cartridge as a safeguard, so that if one set of wires becomes broken or damaged, the shot can be fired by the other wires. In the use of Cordeau primer cartridges are unnecessary, as the lower end of the Cordeau itself is inserted in a cartridge of explosives, and the Cordeau owing to its composition acts as a detonator throughout the entire length of the bore hole in which it is used. For

this reason Cordeau is particularly efficient for use when charges of explosives are broken in a bore or drill hole. While with the use of Cordeau no advantage is gained by the use of detonators stronger than Number 6, it is always a good idea when firing with fuse and caps or electric detonators to use the strongest manufactured. It is also most economical, as explosives and detonators are not always absolutely perfect; nor is the loading of explosives always perfectly placed in the hole. Therefore the strongest detonators are fine insurance against misfires.

In loading operations it is well to remember that chilled or frozen dynamite will not nearly develop its full strength, and it is treacherous to handle. Therefore if operations require the use of dynamite in low temperature or freezing weather, provisions of an approved sort should be provided for thawing purposes. As to just what loss in efficiency is caused by chilled dynamite, various comprehensive tests have been made which show that dynamite which has been chilled for only 1 hour and is not frozen give only 1-3 to 1-2 as satisfactory results and efficiency as dynamite having a temperature of approximately 70 degrees Fahrenheit.

Reference was made previously under the heading, "Action of Explosives," to "dynamite headaches," and the writer feels that further reference should be made to it at this time. In the loading of large shots where it is necessary for men to handle dynamite for as long as 8 or 9 hours at a stretch, certain grades of dynamite will invariably cause headaches with some of the men employed in the operation. As this disability on the part of the worker tends to cut down his efficiency and carefulness, it is to be recommended that these men be watched very closely and their work checked, thereby preventing the possibility of a misfire or a bad shot. While there is no immediate cure for dynamite headache, some relief can be gained by administering to the men affected a combination of part or all of the following bromides in liquid or tablet form: sodium, potassium, lithium, calcium, ammonium. This combination is a sedative to the nervous system and lowers reflex action to induce sleep and further moderates cerebral excitement.

Death Takes John H. Hayward

Mr. John H. Hayward was born in New York on April 7th, 1847 and died in Teaneck, N. J. on June 14th, 1925, at the age of 78.

After graduating from a Military Academy he took a position in the Manhattan Savings Institution, where he stayed for several years. Later he went into the produce business and was a member of the New York Produce Exchange.

Shortly after his marriage 52 years ago, he moved to Staten Island where he met a Dr. Johnson, an inventor, and about this time his thoughts commenced to change from banking and the produce market to machinery and invention. The friendship between Mr. Johnson and Mr. Hayward grew rapidly and the outcome was the first Automatic Bucket. Later the Manhattan Dredging and Elevating Company was organized for the purpose of doing a general contracting business, and Mr. Hayward was the General Manager of this Company. After it went out of business, Mr. Hayward took up the building of buckets himself.

The first Hayward Bucket was known as an "Orange Peel" and was built in a shop located on Washington Street, New York. This and other types of buckets designed by him were so successful that contractors immediately adopted them, and from that time until the present day their field of usefulness has ever broadened. Today they are found in every corner of the world and play a prominent part in practically every industry. This was one of Mr. Hayward's great dreams, and he was one of the few men who lived to see their dreams realized.

At the time of his death he was Vice-President and Treasurer of The Hayward Company of 50 Church Street, New York, N. Y. He was a member of The Engineers Club and The Machinery Club, and was one of the Governors of the latter club and one of its most active members. His entire time was divided between his home, his business and his club.

He was a man with a strong personality and had the happy faculty of not only making friends but of holding their friendships. He was known throughout the country as the "Father of Automatic Buckets". Through his death not only the engineering world but also the business world loses a dominating figure.

Factors Governing Modern Lime Kiln Capacity and Fuel Economy

By Victor J. Azbe, Consulting Combustion Engineer*

Part III

Part I of this paper appeared in the June first number of PIT AND QUARRY. Actual fuel lime ratios, heat distribution in theoretical kilns and kiln efficiency rating were discussed.

In Part II, which appeared in the June 15th number, effects of excess air on lime kiln efficiency, incomplete combustion, and heat loss by radiation were discussed.

This paper was prepared by Mr. Azbe for the Seventh Annual Convention of the National Lime Association held at Briarcliff Manor, New York, May 26, 27, 28 and 29, 1925. It will be published complete in six parts in consecutive numbers of PIT AND QUARRY. EDITOR

Kiln Gas Analysis

Kiln performance can be judged quite well from gas analysis, but the man attempting to do this must learn to obtain the correct and average sample and also must learn to interpret the results of analysis. There are a great many items to be taken into consideration; but if they are all analyzed, the "ratio pounds of lime per pound of fuel" and the "kiln thermal efficiency" can be determined as well as much other information, such as the extent to which a kiln is performing.

The enclosed "Master Chart" for determining kiln efficiency and lime fuel ratio from kiln gas analysis gives both the formula for calculating and the graphical outline. The variables that are taken into consideration to determine efficiency and ratio are: "Heat Value of Fuel," "Available Hydrogen in Fuel," "Carbon Dioxide," "Oxygen," "Carbon Monoxide in Kiln Gas," "Percentages of Calcium Oxide," "Magnesium Oxide" and "Impurities in the Lime Made." The directions for use of the chart are also given on it.

While the chart appears to be quite complicated, it is in reality not at all intricate. It was impossible to make it any simpler because of the great number of variables, all of which have an important bearing. For plants burning a definite kind of coal and using a definite kind of limestone, simpler charts can be assembled from this Master Chart.

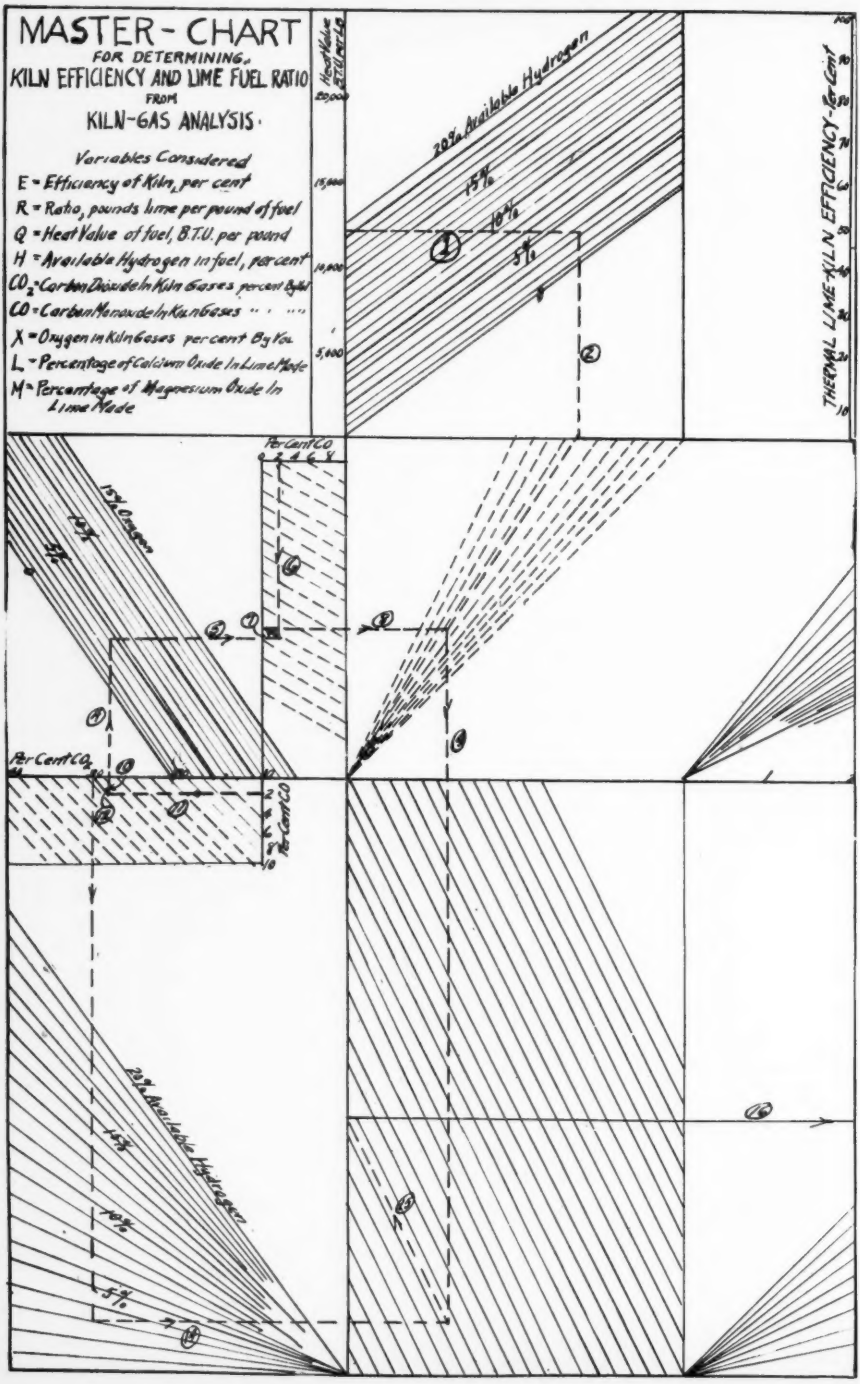
The chart is usable for any fuel up to 20 per cent hydrogen, and therefore fuel oil is included. For any lime containing from 0 to 100 per cent CaO or MgO it has a range great enough to include any obtainable ratio with present day kilns. It takes in incomplete combustion to the extent of 10 per cent CO, excess air up to 15 per cent and carbon dioxide 40 per cent. It does not take into consideration the presence of methane and hydrogen in waste gas.

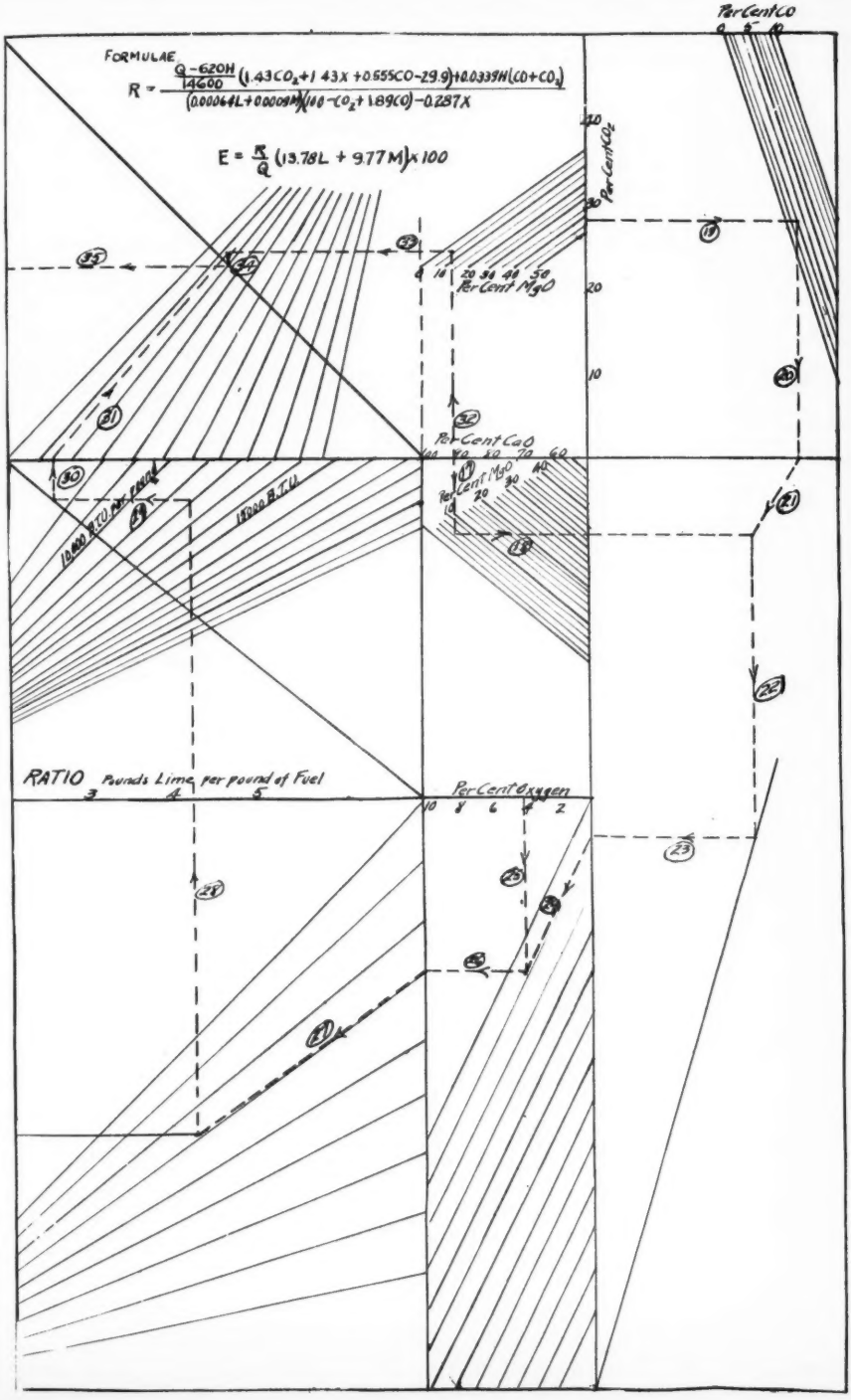
It is, of course, understood that the more CO_2 escapes from the kiln top, the higher will be the ratio, assuming that there is no oxygen in waste gas, that there is no excess air and that the fuel burned is the average bituminous coal. If then the CO_2 found in waste gas is 18.5 per cent, evidently no lime is made because this CO_2 percentage is accounted for by the burning of the carbon in the coal. From this point on, the greater the CO_2 percentage, the more the proportion of the CO_2 driven from the limestone and so the greater the ratio.

A simpler chart, but not as extensive in possible application, is given in Figure 8. The ratio is plotted against the CO_2 and O content of the kiln waste gas, and lines are drawn for different heat values of the bituminous coal burned. This chart was calculated for high calcium stone. It was assumed that the combustion was complete; if combustion is not complete, this chart becomes valueless and the master chart must be used.

It may be well to state that the ratio is based on coal as the coal heat value is taken, both in the master chart and in Figure 8. If the heat value is on a dry basis, the ratio is on a dry basis also; and if the ratio is to be on "coal as received" basis, the heat value of the fuel must be taken that way also. It is well not to take heat values as given out by

*A paper prepared for the Seventh Annual Convention of the National Lime Association held at Briarcliff Manor, New York, May 26, 27, 28, 29, 1925.


MASTER-CHART
FOR DETERMINING
KILN EFFICIENCY AND LIME FUEL RATIO
FROM
KILN-GAS ANALYSIS.
Variables Considered
E = Efficiency of Kiln, per cent
R = Ratio, pounds lime per pound of fuel
Q = Heat Value of fuel, B.T.U. per pound
H = Available Hydrogen in fuel, per cent
CO_2 = Carbon Dioxide in Kiln Gases percent By Vol
CO = Carbon Monoxide in Kiln Gases " " "
X = Oxygen in Kiln Gases per cent By Vol
L = Percentage of Calcium Oxide in Lime Made
M = Percentage of Magnesium Oxide in Lime Made
Heat Value B.T.U. per Lb.
20,000
15,000
10,000
5,000
20% Available Hydrogen
15%
10%
5%
THERMAL LIME-KILN EFFICIENCY - Per Cent
Per Cent CO
15% Oxygen
10%
5%
Per Cent CO_2
Per Cent CO
20% Available Hydrogen
15%
10%
5%


FORMULAE
$R = \frac{Q-620H}{14600}(1.43CO_2+1.43X+0.655CO-29.9)+0.0339H(CO+CO_2)$ / $(0.00064L+0.00097M)(100-CO_2+1.89CO)-0.287X$
$E = \frac{\pi}{Q}(13.78L + 9.77M)\times 100$
Per Cent CO
Per Cent CO_2
Per Cent MgO
Per Cent CaO
Per Cent MgO
RATIO Pounds Lime per pound of Fuel
Per Cent Oxygen
18000 B.T.U.
18000 B.T.U. per pound

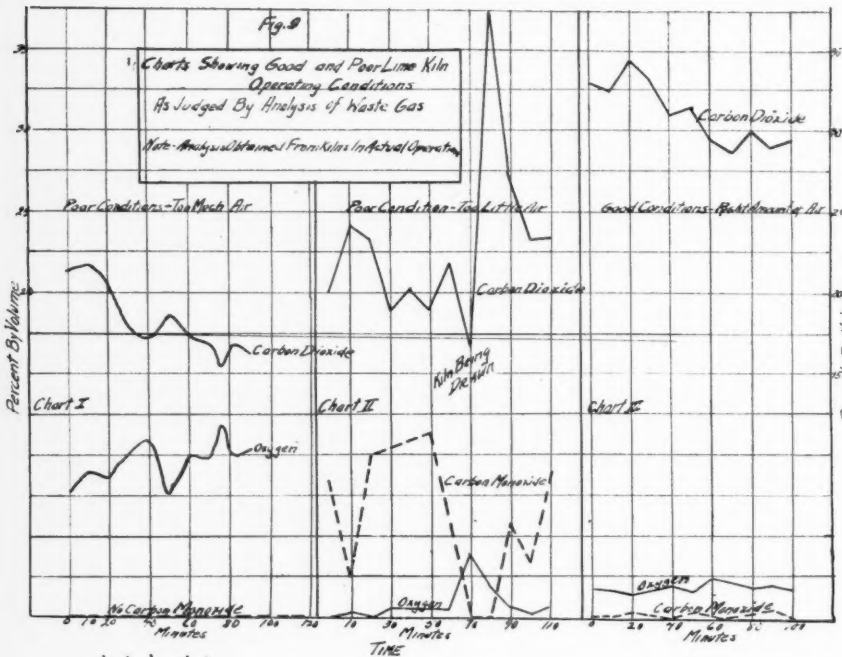


Fig. 8
Charts Showing Good and Poor Lime Kiln Operating Conditions As Judged By Analysis of Waste Gas
Note: Analyses Obtained From Kilns In Actual Operation
Poor Condition—Too Much Air
Poor Condition—Too Little Air
Good Conditions—Right Amount of Air
Carbon Dioxide
Oxygen
Carbon Monoxide
Kiln Being Checked
Chart I
Chart II
Chart III
Percent By Volume
Minutes
TIME

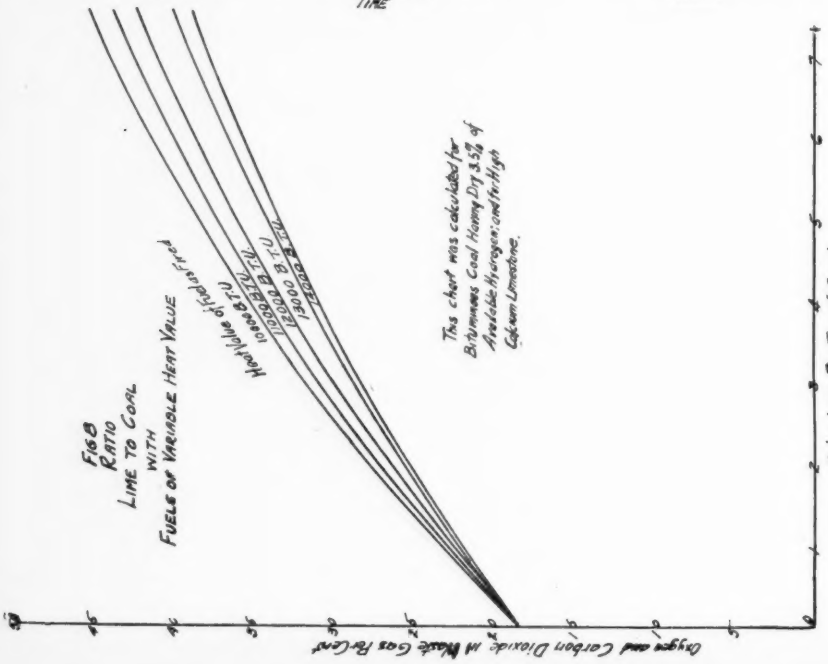


Fig 8
Ratio
Lime to Coal
With
Fuels of Variable Heat Value
Heat Value of Fuel as Fired
10000 B.T.U.
11000 B.T.U.
12000 B.T.U.
13000 B.T.U.
This chart was calculated for Bituminous Coal Having Dry 3.5% of Available Hydrogen and for High Calcium Limestone.
Oxygen and Carbon Dioxide in Waste Gas Per Cent
Ratio Lime Per Ton of Coal

the coal companies, because they are quite often far higher than the actual values.

The chart indicates that the ratio varies with the variation of the combined O and CO_2, and the higher the two, the higher will be the ratio. This should not be taken, however, to indicate that a higher oxygen content is desirable. That it is highly detrimental was explained. In this chart it merely indicates that the total volume increases when excess air is used, and thus the CO_2 becomes diluted, but it happens that the oxygen has a proportionate volume value to the CO_2. If the oxygen figure should be reduced and CO_2 increased, after a time the kiln would get in better condition, the ratio would become higher, and so also the combined figure of O and CO_2, than was the case of very high O.

Results of Kiln Gas Analysis Tests Made at Different Plants

Figure 9 gives three charts; the results shown were actually obtained in different plants. Chart I illustrates poor operating conditions due to excess air. It will be noted that there is no carbon monoxide so combustion is complete; but there is a great excess of air as shown by the high oxygen content. The kiln is getting in bad condition very rapidly; the CO_2 is dropping. When the test was begun, the combined figure CO_2 and O was 30.5 per cent. After one hour and a half operating with high O, the combined figure is 26.5 per cent, and it is continuing to drop. The kiln is making lime on stored heat, not much on the heat put into it. It soon will reach the point where its capacity will be so low that operation will not be practical unless conditions are improved.

Chart II shows poor conditions again, but in this case due to too small amount of air and consequent incomplete combustion. Carbon monoxide is very high, at one time as high as 11½ per cent. Oxygen is very low except when the kiln was drawn. During an ordinary run the amount of oxygen is less than 1 per cent, and that must be leaking into the kiln above the zone where combustion is taking place.

The high CO_2 observed immediately after drawing is a peculiarity often encountered. It can be due to two causes, one being that long flames penetrated to the zone where the stone was fully preheated but entirely undecomposed on its surface and so a large amount of CO_2 gas was rapidly given off. The second possibility is that after the fire was cleaned, a very large amount of coal was thrown on the grate practically sealing the grate to air admission. The fuel bed, being cold, did not have sufficient draft effect of its own to draw in air, and since the kiln stone kept on giving off CO_2 on stored heat, the percentage naturally greatly increased. Here the kiln was gas fired; but if air and gas are shut off, the same effect will result. After drawing, the carbon monoxide immediately came back up again, and oxygen dwindled down to less than one per cent.

Chart III of Figure 9 illustrates good conditions. Oxygen ranges around 2 per cent; carbon monoxide is practically absent and CO_2 is high, especially during the first part of the test. Conditions are regular; there is little fluctuation. The only peculiarity that would make one claim that the conditions could be improved is the dropping CO_2, which will be explained in the section on "Heat Transfer."

Figure 10 gives waste gas analysis in another plant where the hand firing was exceptionally regular and frequent. The carbon monoxide was present even before firing, while after firing it increased by several per cent. The amount of CO also continued to increase the dirtier the fire got, and on the last analysis four hours after cleaning and one hour before the next drawing, 9½ per cent CO was found in the waste gas. Oxygen was entirely absent, except during the drawing period when it was very high. At 12:45 the oxygen was 16 per cent and no fire whatever was on the grates, so no CO_2 was evolved from combustion. The percentage, however, of CO_2 in waste gas was 10 per cent. all from the limestone which continued to give off CO_2 with stored heat.

Figure II is most interesting. The results were obtained from a hand fired lime kiln. The fireman did not know that he was being watched and so was caught when he fired very heavily. Then, for two hours he did not put any more coal on the grates. At 2:15 P.M. he fired, with immediate

FIG. 10
WASTE GAS ANALYSIS

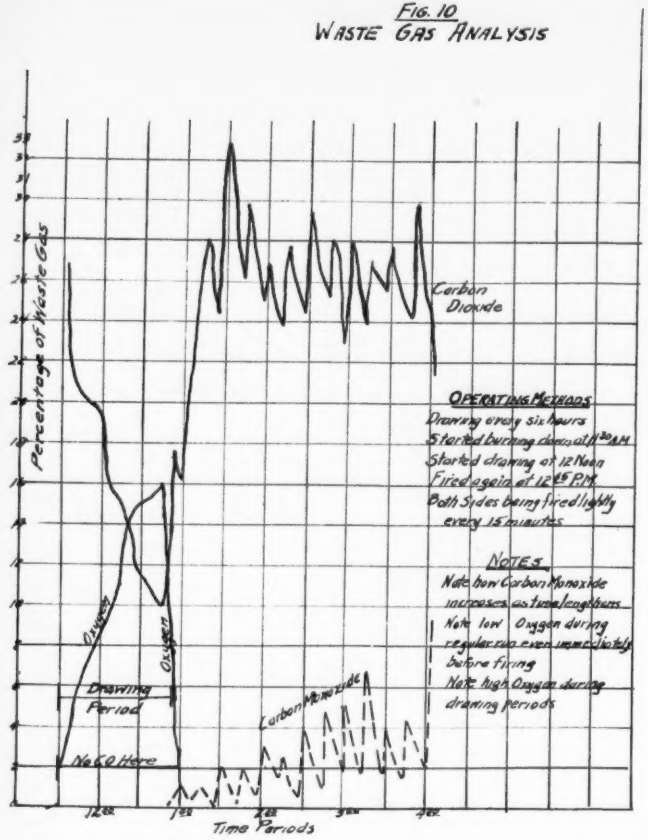
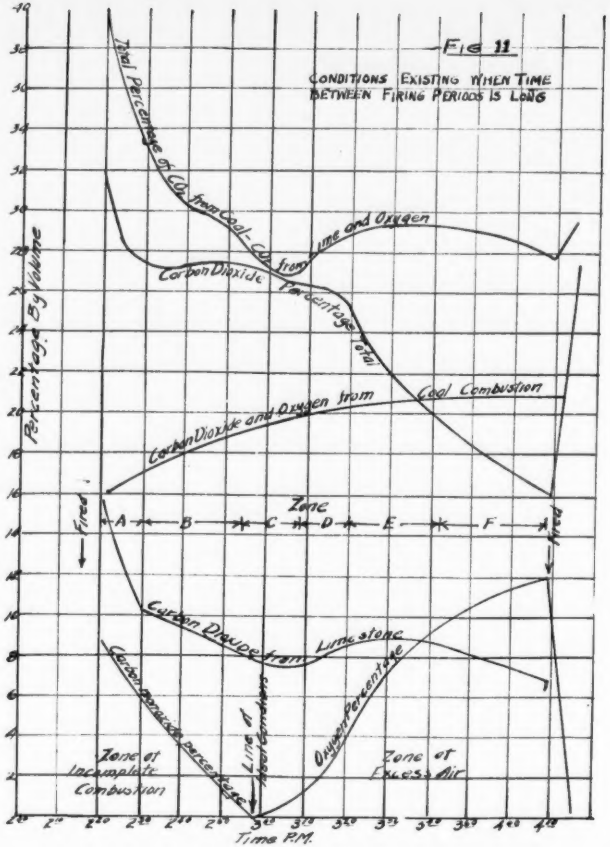

Percentage of Waste Gas
Carbon Dioxide
Oxygen
Carbon Monoxide
Drawing Period
No CO Here
Time Periods
OPERATING METHODS
Drawing every six hours
Started burning down at 11:30 A.M.
Started drawing on 12 Noon
Fired again at 12:45 P.M.
Both Sides being fired lightly every 15 minutes
NOTES
Note how Carbon Monoxide increases as time lengthens
Note low Oxygen during regular run even immediately before firing
Note high Oxygen during drawing periods

FIG 11
CONDITIONS EXISTING WHEN TIME BETWEEN FIRING PERIODS IS LONG



great waste of carbon monoxide from the kiln top. At 2:20 the carbon monoxide was 8½ per cent which amount gradually reduced until at 2:57 there was no CO. When the coal was fired, the amount was so great that for a short time there was little air passing through the grate. This is shown by the high percentage of CO_2 in relation to other gases. This is due to less gas volume coming from the furnace, and therefore the gas evolved from limestone predominated to a greater extent. For convenience the figure is divided into zones from A to F.

Zone A. The incomplete combustion was here at its worst, partly because the fuel bed was clogged and partly because the long flame licked up far into the kiln and decomposed some of the rock which did not as yet have an insulating layer of lime on its surface. The waste of fuel in this zone was very great.

Zone B. Incomplete combustion still continues, but the carbon dioxide coming off from the lime, while less than in Zone A, is still high. This is probably all due to the long flame licking up high into the kiln. This long flame is the result of the distillation of volatile matter. The fuel waste in this zone is still great.

Zone C. This zone of 21 minutes duration is ideal from the combustion standpoint. Carbon monoxide during its earlier part disappears, and oxygen during its later part does not get high. Peculiarly, here the kiln is making the least lime which is shown by the low CO_2 evolution from the limestone. This is due to wasteful conditions existing in Zones A and B.

Zone D. Here combustion is going on with an increased amount of excess air shown by the rapidly raising oxygen curve. This means waste. Still the CO_2 from the lime is increasing which means that we are just beginning to realize on the ideal combustion conditions that existed in the previous Zone C.

Zone E. Here the kiln makes the most lime in the burning zone. The CO_2 from the lime is high. Here we are realizing at the fullest the benefits from Zone C operating conditions. Combustion is, however, wasteful. Oxygen is still increasing.

Zone F. The kiln is operating with great waste. Excess air is very high, and the lime in the kiln is cooling and the CO_2 from the lime is dropping which means that production is dropping off rapidly. At 4:09, the time just before firing, the kiln was making 24 per cent less lime than it did at 3:30, and what lime was made was due to the heat imparted in Zones C, D and E. The coal burned in Zone F is a total loss, in fact, more since temperatures are so low, due to the great amount of excess air, that lime charge is being cooled and possibly some of the lime recarbonated.

The conditions in a lime kiln, judged in part from the charts given in this section of the article, are very complex. With a direct fired kiln it is impossible to maintain conditions just right. They can only be approximated.

Bristol Recording Instruments

Some of the latest developments in Bristol's Electrical Recording Instruments are described in Bulletin No. 332, just issued by The Bristol Company of Waterbury, Conn. This bulletin supplements Catalog No. 1501.

In this bulletin are shown the improved models of Bristol's Electrical Recording Instruments including Voltmeters and Ammeters. These new models supersede those in Catalog No. 1501.

All of the new instruments have Aluminum cases with plain fronts and black enamel finish. This is not only an improvement in the looks of the instrument itself, but gives a uniformity of appearance where several different types of instruments are to be used on panel boards.

Improvements have also been made in the coils and electrical elements throughout. However, the original basic principles of operation have been retained.

Uehling Appoints

The Uehling Instrument Company of Paterson, N. J., has just appointed Mr. Charles M. Bullard, 912 Washington Street, Appleton, Wisconsin, as their representative for central and northwestern Wisconsin, to handle the Apex CO_2 Recorder and their other power plant instruments. Mr. Bullard is well acquainted with combustion problems in this territory, having had a long and varied experience there as a paper mill engineer.

Northwest Lime Company's Operations

By PERCY E. WRIGHT, Consulting Mechanical Engineer

A RECENT addition to the lime industry of Washington is forecast in the development of a property owned by the Northwest Lime Co., of Seattle, whose holdings consist of approximately 200 acres near the Village of East Sound, Orcas Island, where a modern lime plant is to be built for the production of raw lime rock, lump lime and hydrate.

Contrary to reports which were circulated early in April, or about the time the Company was organized, the property is not one of those heretofore worked, but is a property on which only prospecting has been done, this consisting of open cut work and the sinking of pits at various points on the deposit.

From East Sound the property is reached by a good country road on the west and by the Mount Constitution road on the north, and is ideally situated for water shipment of the various products.

The limestone outcrops at an elevation of 500 feet and at a distance of 3300 feet back from the beach, the connection between these points being a 330 foot right-of-way terminating in a 10 acre plant site on tide-water, where a 600 foot frontage provides ample space for the construction of kilns, hydrator, storage warehouses and wharf.

As in similar deposits on the San Juan Islands, the limestone is white to bluish gray in color, the deposits being in rocks of the Carboniferous Age, or older. The bed now exposed by prospecting is estimated as having a workable thickness of 60 feet and an area of 30 acres. It is apparently less folded than similar nearby deposits, and, with a dip of approximately 10 degrees and other favorable conditions, should permit of easy quarrying.

Recent samples of the deposits were opened, and analyses made at the Pacific Coast Testing Laboratory, Seattle, show the following chemical characteristics:

Calcium Carbonate 95.00% to 96.36%
Silica (Average of 5 samples) .64%
Oxides, Iron and Aluminum, .12%

Burning and hydrating tests also indicate that the limestone is of a suitable quality for the production of a lump lime and hydrate that should find a ready market in competition with the similar products of companies now operating in the Northwest.

The plant will consist of the usual quarry equipment, including gasoline power shovel and aerial tramway,while the burning and hydrating equipment will be that of the Schaffer Engineering Company, of Pittsburgh, with whom a contract has been placed for semi-automatic shaft kilns, 17x78 feet, and a continuous hydrator. Kilns will be wood fired, thus utilizing a suitable and easily accessible fuel of which there is an abundance on the property.

The purchase of the property, and the construction of the plant, was decided upon after a very thorough investigation of the deposit and of market conditions. Among those who personally investigated and passed upon these considerations were Maurice J. Hopkins, Consulting Economic Geologist, Seattle, and Frank W. Schaffer, Secretary, of the Schaffer Engineering Company, Pittsburgh.

The personnel of the company is as follows: Lawrence Keefe, President, Charles E. Clendenney, Vice-President & General Manager, D. L. Evans, Vice President, Charles H. Graves, Secretary & Treasurer and Dr. Chas. W. Littlefield, Trustee. Seattle offices of the company are at 300 Mehlhorn Building.

Phosphate Rock Mined and Shipped in 1924

The phosphate rock shipped from mines in the United States in 1924 amounted to 2,771,000 long tons, valued at $9,740,000, according to preliminary figures made public by the Department of the Interior, which were compiled by the Geological Survey. Florida, the leading state, shipped 2,336,000 long tons, worth $7,507,000, more than nine-tenths of which was land-pebble phosphate. Shipments from Tennessee and small quantities from Kentucky amounted to 396,000 tons, worth $2,039,000. Idaho, Montana, and Wyoming made small shipments.

The phosphate rock mined in the United States in 1924 amounted to 2,756,000 long tons, which is 6 per cent less than that mined in 1923. More than four-fifths of it was mined in Florida. Most of the remainder was mined in Tennessee and Kentucky, though a small quantity was mined in Idaho, Montana, and Wyoming.

Operating A Sand And Gravel Plant Under Favorable Conditions

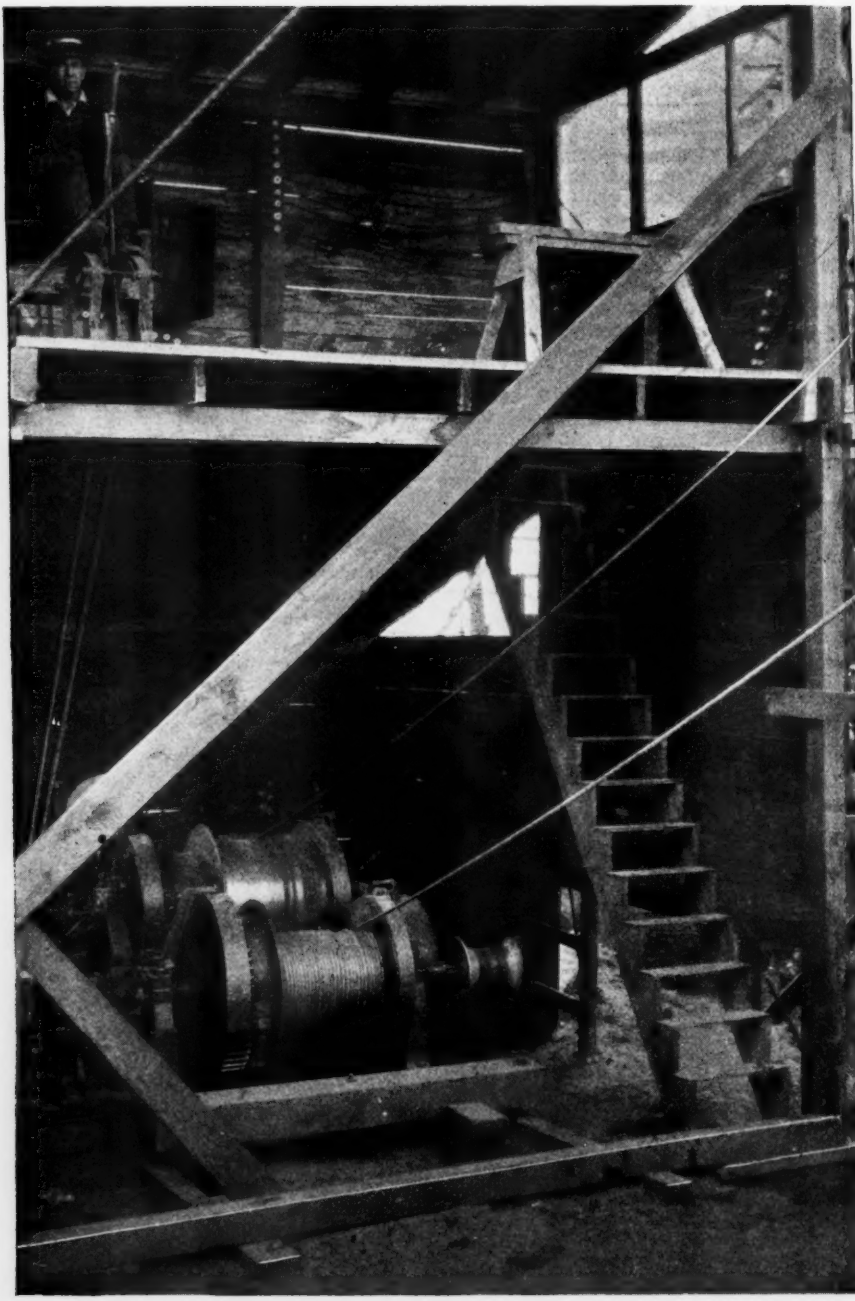
Plant Serves Unusual Market By Highway, Rail And Water Efficient Scraper Operation Producing 800 Yards Daily

INTERESTNG operations are carried on by the Croton Sand and Gravel Company at their plant at Croton-on-Hudson, 35 miles north of New York City on the Albany Post Road. The operations are interesting from many angles. The present market is right along the Hudson River with a good demand just across the river from the plant. Nearly all the sand produced is sold to consumers engaged in making clay brick. The Haverstraw brick yards are directly across the river from the Croton plant. Kingston is also another brick center, and an active market for the Croton Sand and Gravel Company.

The location of the Croton plant saves the towing charges which have to be added to the price of the competitor's product. Considerable sand and practically all of the gravel produced is sold through dealers at such points at Yonkers, Tarrytown, Ossining and Peekskill for general construction work. Shipments to these dealers is made by truck. Sand for the brick yards is delivered by barge. The loading equipment is capable of loading two barges a day and can be made to load three when necessary. A minimum of 500 yards a day is distributed by barges. The railroad facilities at the Croton plant are not adequate. The company, however, is negotiating at the present time for a siding into the plant which, if accomplished, will come within a few feet of the storage piles. These cars can then be loaded easily from outside storage by portable loaders or cranes. The use of portable loaders or cranes will be more practical with the present plant than storage bins built over the railroad siding.

The deposit being worked is a hill formation with the greatest portion at a height above the plant. Laboratory tests made by Columbia Uni-

View of Plant Showing Screening Plant



Electric Scraper Hoist. Operator Controls Levers on Floor Above Hoist with Excellent View of Pit and Without any Discomfort

versity rate this sand as having a higher compression test than the standard Ottowa testing sand. The sand burns well and makes an excellent clay brick. The deposit, which is under leasehold by the Croton Sand and Gravel Company, contains about one million yards of sand and gravel.

The plant is operated entirely by electricity. A 75 H.P. Sauerman electric double friction drum scraper hoist operates a 2 yard Crescent power drag scraper. The hoist operates with a rope speed of 200 feet per minute coming in and has a return speed of 600 feet per minute. The Crescent scraper dumps into a bar grizzly through which all material passes to a hopper. This hopper is located about 75 feet from the screening plant. From the hopper the material is fed by a Robbins automatic apron feed to a 20 inch belt conveyor. This conveyor discharges over a grid through which the material must pass to the elevator buckets. Anything not passing the grid is carried to a hopper which feeds a number 4 Champion jaw crusher. The feed to this crusher is controlled by a gate. The crushed stone and gravel are fed through a chute to the same bucket elevators which receive the sand and gravel passing the grid.

The bucket elevator lifts the material and discharges into a double chute feeding two gear driven screens. These screens are 18 feet long and 54 inches in diameter. The screens, which have a capacity of 1000 yards per 8 hour day and a washing capacity of 800 yards per 8 hour day, revolve over two large hoppers which receive the gravel and stone. The sand is washed down through a trough into three wash boxes.

The washing process is accomplished through the medium of two pipe lines, one in each screen. These pipe lines bring the water from the Hudson river through two 3 inch Worthington horizontal class "C" volute centrifugal pumps which are connected by a belt drive to two 25 H.P. motors. With these pumps and a motor speed of 1475 R.P.M., water is supplied at the rate of 400 gallons per minute. The sand is thoroughly washed and the loam is carried off through a trough back into the river. The washed sand is discharged from the wash boxes to a stockpile in front of the boxes.

Scraper Dscharging Load to First Grizzly

From the stockpile the sand is loaded by a stiff leg derrick equipped with a one yard bucket either into an auxiliary hopper for local truck deliveries or onto a 20 inch belt conveyor for loading to barges. This derrick is operated by a Ligerwood 60 H.P. three tandem friction drum electric hoist. This hoist has a rated pull of 8000 pounds at 200 R.P.M.

When material is loaded for barge delivery, it is picked up by the derrick and placed on a 20 inch belt conveyor which conveys it under a state highway a distance of 250 feet, where it discharges to another 20 inch belt conveyor. This second belt conveyor with a capacity of 200 tons per hour discharges to a loading chute from which the barges are loaded. The second belt conveyor carries the material also a distance of 250 feet, and it travels under the tracks of the New York Central Railroad. This method of breaking the conveying into two sections of belt was done to permit the building of a storage pile at the break. Such an arrangement prevents a more flexible plant arrangement.

These two conveyors, as well as the others and also the elevators, were built by the Robins Conveying Belt Company. The conveyors are equipped with Manhattan 5 ply ⅛ inch rubber belts. The screening equipment and wash boxes were purchased from the Good Roads Machinery Company and installed by the Croton Sand and Gravel Company. A 25 H.P. Allis Chalmers motor drives the screens. Five General Electric motors are used for driving the conveyors, crusher, derrick and scraper.

When the railroad siding from the New York Central Railroad is run into the plant, the Croton Sand and Gravel Company will be able to ship by water, rail and truck. This feature and also the unique market conditions characterize this operation as one of the unusual sand and gravel plants of the country.

The plant is operated by a force of ten men. This organization includes two engineers, one watchman, one clerk, five laborers and one foreman. The officers of the Croton Sand and Gravel Company are: P. M. Dwyer, President; J. B. Palamara, Treasurer; and A. C. Perrault, Secretary.

A New Drag Clam Bucket

A new bucket known as the Dunbar drag clam combines the features of the dragline bucket with those of a clamshell. The bucket is adaptable to all classes of dragline work. It is designed principally for gravel excavation and stripping work.

The drag clam enters the bank at a sharp angle, and the pull of the dragline is intended to obtain the maximum load with the shortest possible drag. With a full load in the bucket the strain on the hoisting line causes the arm to raise and this action crowds all the material between the movable jaw and the cutting edge into the bucket.

The drag clam in carrying the load is slack, and there is no strain. The load can be dumped all or in part by regulating the pull on the dragline.

The New Dunbar Scraper

Gondola Car Dumper Book

Link-Belt Company of Chicago, Philadelphia, and Indianapolis has just issued an eight page booklet which describes the operation and use of the Link-Belt Gondola Car Dumper. This book is replete with photographs of installations and line drawings showing method of operation.

Recent Patents

The following patents of interest to readers of this journal recently were issued from the United States Patent Office. Copies thereof may be obtained from R. E. Burnham, patent and trade-mark attorney, Continental Trust Building, Washington, D. C., at the rate of 20 cents each. State number of patent and name of inventor when ordering.

1,537,947. Separator for coal and ore. Effingham P. Humphrey, Upper Lehigh, Pa.

1,538,421. Rock-drilling machine. Omar E. Clark, Denver, Colo., assignor to Denver Rock Drill Mfg. Co., same place.

1,538,684. Mining-machine. Frank Cartlidge, Terre Haute, Ind., assignor to Sullivan Machinery Co., Claremont, N. H.

1,538,685. Mining-machine. Frank Cartlidge, Terre Haute, Ind., assignor to Sullivan Machinery Co., Claremont, N. H.

1,538,703. Crushing-roll. George Johnston, Manchester, England.

1,538,922. Guide or fair-lead for the drag-rope of a drag-line excavator. Hubert O. Bedgood, Glasgow, Scotland, assignor to Lobnitz & Company, Limited, Renfrew, Scotland.

1,538,947. Excavating apparatus. William J. Newman, Chicago, Ill.

1,538,969. Grab. Norman I. D. Burke, Auckland, New Zealand.

1,539,099. Power-shovel. John F. Sullivan, Medford, Mass.

1,539,130. Power coal-shovel. Oswald Luschnig, Nokomis, Ill.

1,539,144. Dirt-loader. Port A. Price, Richmond, Cal.

1,539,218. Gravel-loader. Howard E. Stiles, Bolivar, Mo.

1,539,237. Screening ball mill. Walter O. Borcherdt, Austinville, Va.

1,539,765. Shovel. William C. Page, Oceanpark, Cal.

1,539,863. Excavating-dipper. Edward L. Pemberton, New York, N. Y.

1,539,948. Driving system for roll-crushing machines. Alexander G. McGregor, Warren, Ariz.

1,540,167. Screen for rock-drills. Kenneth O. Duncan, San Francisco, Cal., assignor to Denver Rock Drill Mfg. Co., Denver, Colo.

1,540,314. Pocketed bottom for excavating-dippers. John O'F. Clark, Chicago Heights, Ill., assignor to American Manganese Steel Co., Chicago, Ill.

1,540,327. Loading-machine. Robert P. Greenleaf, Shaker Heights, Ohio, assignor to Frank Billings, Cleveland, Ohio.

1,541,064. Grab. Almon E. Norris, Brookline, Mass.

1,541,464. Drag-line excavator. Hubert O. Bedgood, Glasgow, Scotland, assignor to Lobnitz & Co., Ltd., Renfrew, Scotland.

The E. M. Bassler Scrubber

The D. J. Murray Manufacturing Company of Wassau, Wisconsin, has issued a new bulletin descriptive of the E. M. Bassler air and gas scrubber. This machine utilizes the wet system of collecting and delivering dust by means of centrifugal action. The apparatus was invented by Mr. E. M. Bassler, who has devoted 35 years to air conditioning problems.

In the operation of the scrubber the scrubbing fluid which may be water, oil or soluble chemicals, is delivered to a spray wheel through a nozzle which envolves a bronze cased shaft. The gas or air enter the scrubber through an inlet cone and is evenly distributed over a rapidly revolving wheel which breaks up the fluid into very fine particles. The broken up fluid entirely envelops the pins and the spaces between them through which the dust laden air or gas must pass. The dust is thoroughly saturated and with the scrubbing fluid is thrown against a splash skirt and grid with great force. This causes the dust and the broken up scrubbing fluid to separate from the air or gas and assume a high degree of concentration. The air or gas then passes under the splash skirt and around the outside of the cone to the outlet. The scrubbing fluid with the dust that has been extracted drops from the skirt and grill to a tank directly below.

The Bassler air and gas scrubber is simple, durable and efficient. All parts are interchangeable. The construction throughout is of rust and wear resisting material. The stationary parts are of cast iron while the rotating parts are of steel, bronze or semi-steel, as desired. The scrubber will treat air or gas up to temperature of 2000 degrees F. and will handle materials that are fine or coarse, stringy or abrasive.

Distribution of Cement

The following figures show shipments from Portland cement mills distributed among the States to which cement was shipped during January, February, March and April, 1924 and 1925. Portland cement shipped from mills into States, in January, February, March and April, 1924 and 1925, in barrels a.

Shipped to	Year 1924	January 1924	January 1925	February 1924	February 1925	March 1924	March 1925	April 1924	April 1925
Alabama	1,871,885	81,010	85,410	141,946	103,513	166,154	177,510	162,471	191,451
Alaska	6,304	0	132	0	0	132	294	231	709
Arizona	389,935	14,185	34,370	27,700	25,945	25,659	27,009	30,146	31,264
Arkansas	1,099,304	60,791	41,376	54,340	44,352	82,059	72,198	105,078	94,695
California	10,772,733	856,997	988,883	757,383	753,123	850,536	1,029,118	899,357	1,027,744
Colorado	1,334,493	35,905	42,425	65,752	69,871	58,747	102,537	111,833	131,363
Connecticut	1,576,021	50,230	34,810	38,283	50,026	73,917	113,668	143,013	160,616
Delaware	384,228	8,431	5,786	10,088	9,444	15,035	21,766	38,393	41,573
District of Columbia	718,146	32,480	37,285	43,695	65,176	51,768	58,474	55,800	70,765
Florida	2,155,836	124,981	265,463	154,556	227,811	157,704	272,094	140,291	261,180
Georgia	1,406,476	80,789	93,062	75,087	98,569	104,100	140,634	114,026	112,250
Hawaii	40,587	8,182	417	6,947	0	2,953	1,500	5,478	2,250
Idaho	262,142	16,193	2,598	20,885	11,029	16,502	17,667	30,538	28,393
Illinois	13,309,655	397,878	463,388	547,057	378,947	962,510	846,638	1,366,987	1,467,815
Indiana	5,492,150	126,203	139,782	214,900	143,464	283,594	255,597	454,111	433,996
Iowa	3,138,347	51,542	53,044	87,144	52,039	146,692	161,164	254,796	284,477
Kansas	2,128,898	46,443	33,588	88,298	120,405	124,379	212,402	248,942	232,220
Kentucky	1,727,038	33,644	52,013	51,025	68,970	103,672	115,222	156,403	174,795
Louisiana	1,255,952	97,861	75,992	91,162	97,638	110,922	98,193	140,357	108,250
Maine	386,092	10,447	4,837	10,751	5,238	22,975	21,702	34,998	36,163
Maryland	1,983,993	53,641	47,635	67,471	98,231	131,737	143,291	163,161	207,844
Massachusetts	3,352,294	106,833	113,101	98,888	134,591	188,117	257,381	309,111	344,406
Michigan	9,335,798	203,148	190,905	229,929	248,240	424,546	437,712	655,933	859,815
Minnesota	3,238,161	61,434	59,395	141,008	97,034	212,160	173,618	240,635	321,854
Mississippi	507,201	25,907	29,867	29,194	28,564	28,800	35,778	41,698	48,174
Missouri	3,929,248	75,714	115,141	134,634	162,992	201,370	379,157	392,769	489,316
Montana	202,541	4,261	5,334	6,443	6,093	10,033	16,450	23,446	23,030
Nebraska	1,496,892	47,874	31,832	49,306	46,281	78,210	99,780	153,517	180,951
Nevada	90,949	1,335	2,492	4,251	5,177	6,258	7,254	7,625	10,767
New Hampshire	377,917	11,482	9,419	15,734	15,911	27,155	27,592	35,556	39,906
New Jersey	6,345,124	229,051	157,612	194,146	243,534	373,059	498,227	537,307	722,751
New Mexico	236,644	7,796	7,911	16,129	10,320	16,007	18,865	24,154	19,699
New York	17,282,302	562,858	400,896	518,381	587,674	1,043,786	1,159,830	1,558,728	1,717,441
North Carolina	2,846,808	86,661	79,817	120,775	128,770	161,171	200,097	232,887	277,616
North Dakota	270,354	1,958	1,380	3,277	3,742	15,741	16,589	25,531	38,937
Ohio	9,201,578	249,298	259,628	317,151	271,075	501,408	592,069	752,723	894,683
Oklahoma	2,201,699	97,193	58,872	147,337	155,083	162,654	203,161	269,777	201,886
Oregon	1,205,672	33,227	54,117	63,985	60,816	90,932	103,813	120,593	101,661
Pennsylvania	12,950,829	389,298	288,916	387,651	421,519	641,390	808,636	954,720	1,250,501
Porto Rico	6,686	0	0	0	0	0	0	0	0
Rhode Island	612,344	18,385	15,668	17,657	17,908	30,219	54,083	56,400	79,063
South Carolina	571,372	38,077	46,840	43,033	73,312	49,767	72,929	49,837	65,806
South Dakota	472,154	5,610	4,331	18,052	14,528	36,289	40,697	37,602	57,039
Tennessee	1,590,992	63,721	69,669	69,912	87,499	104,162	116,856	147,706	133,037
Texas	3,844,187	237,761	260,540	231,256	345,057	295,361	381,320	389,892	401,517
Utah	429,630	8,378	3,794	20,603	16,821	30,921	28,567	45,073	33,469
Vermont	337,146	21,778	3,129	10,833	3,060	13,614	10,312	23,082	25,353
Virginia	1,685,953	85,440	54,445	78,029	95,942	141,142	132,891	179,862	160,139
Washington	1,831,348	102,917	85,969	81,153	90,669	153,249	151,814	167,640	180,845
West Virginia	1,663,250	49,066	45,912	54,328	56,629	72,567	85,703	147,927	134,357
Wisconsin	4,357,044	58,334	113,396	136,899	73,320	239,493	142,620	377,659	358,379
Wyoming	328,221	6,881	3,492	11,266	9,181	13,079	16,358	22,017	19,981
Unspecified	684,598	54,183	15,964	51,524	26,430	55,950	46,236	69,520	34,875
	144,927,151	5,133,692	5,092,090	5,857,234	5,961,563	8,910,357	10,205,073	12,707,337	14,327,067
Foreign countries	819,849	76,308	69,910	75,766	53,437	84,643	73,927	63,663	66,933
Total shipped from cement plants	145,747,000	5,210,000	5,162,000	5,933,000	6,015,000	8,995,000	10,279,000	12,771,000	14,394,000

a Includes estimated distribution of shipments from three plants for February, March and April, 1924; from four plants for January and February, 1925; and from five plants for March, 1925 and five for April, 1925.

The O. K. Portable Air Compressors

The O. K. Clutch and Machinery Company is now manufacturing gasoline and electric portable air compressors. These machines are manufactured in three sizes, all substantially the same in design and construction.

The frame is made of standard structural steel members with the depth of channel varying with the size of the unit. These members are united by the electric arc welding process forming one solid unbreakable frame.

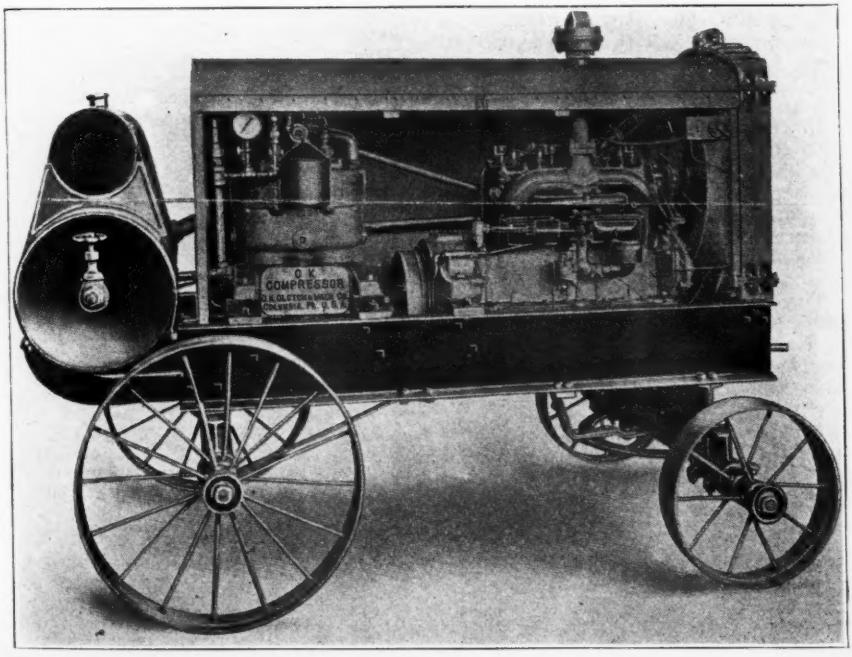
The radiator is of O. K. special design. The unit is mounted on a standard four wheel truck of sturdy construction with steel tired wheels. Rubber tired wheels or spring mounting are furnished if desired.

All units use a compressor of the same type but varying in size. All parts that might require adjustment are accessible. The cylinders are of close grained grey iron carefully machined. The cylinders are cast en-bloc and are completely surrounded by the water jacket. The suction and discharge valves which are located in the cylinder head are also surrounded by water.

The air valves are of the "duo plate" type made of special hardened steel with a separate plate over each port. The crank case is a rigid casting. The pistons and connecting rods are of the automobile type. The crank shaft is an extra large drop forging of chrome vanadium steel heat treated.

The gasoline engine is a standard four cylinder four cycle heavy tractor type directly connected to the compressor by a special O. K. clutch and coupling. This engine is of the L head type with four point suspension and is rigidly attached to the main frame. The engine has a standard type automobile carburetor, high tension impulse magneto and a crank case oil gauge.

The O. K. compressor is furnished with compressor, engine, cooling system, fuel tank and an extra large riveted air tank. It is mounted on a one piece steel channel frame and has a cast iron radiator steel housings and a steel tired truck. The compressor is equipped with safety valves, suction unloader and tools.



The O. K. Portable Air Compressor

Foreign countries	144,927,151	5,155,692	3,052,050		75,766	53,437	84,643		73,927	63,663		66,933
Total shipped from cement plants	819,849	76,308	69,910									
	145,747,000	5,210,000	5,162,000	5,933,000	6,015,000	8,995,000	10,279,000	12,771,000	14,394,000			

Talc and Soapstone in 1924

The total quantity and value of talc and soapstone sold by producers in 1924 was 203,821 short tons, valued at $3,515,556, according to figures issued by the Department of the Interior, through the Geological Survey. These figures represent an increase of 4 per cent in quantity and of 17 per cent in value over the amounts for 1923. There were 27 producers in 1924, as compared with 25 in 1923.

The following table shows the quantity and value of talc and soapstone sold in 1924, by States, and the percentages of increase or decrease from 1923.

The talc industry in New York in 1924 was prosperous, and the sales showed substantial increases in quantity and value over 1923. A new use for talc as an ingredient in concrete to make it waterproof, was reported to the Survey by one company, which made experiments with favorable results. This company has also experimented with special grades of talc as a high-grade paper filler.

The year opened in Vermont with increasing firmness in prices over 1923. The demand was good and remained so until the end of April. A quiet two months followed, and in July signs of improvement were again noticeable, with a gradual tendency toward better conditions until about the first of November, when the demand again declined.

In the South soapstone was mined with renewed activity in North Carolina and Virginia; in Maryland there was a gain of two producers and greatly increased sales over 1923, and in Georgia sales of talc crayons were noticeably larger.

The Dean Hill Pump Company announces the appointment of Wagner & Wagner, El Paso, Texas as their local dealer in the El Paso Territory. Also Mr. J. Harry Burroughs, 502 Marine Trade Building, Buffalo, N. Y. as their local representative in the Buffalo District.

State	1924 Short tons	1924 Value	Per cent of total quantity	Percentage of increase or decrease from 1923: Quantity	Percentage of increase or decrease from 1923: Value
New York	78,340	$1,162,488	38	+ 10	+ 8
Vermont	61,653	573,747	30	— 8	+ 8
Virginia	28,219	1,306,388	14	+ 8	+36
California	16,335	247,799	8	+ 1	+10
Pennsylvania and New Jersey	8,281	83,296	4	+ 1	+ 1
North Carolina	6,093	81,523	3	— 6	— 9
Maryland	3,015	29,767	2	+420	+17
Georgia	1,885	30,548	1	+137	+84
	203,821	$3,515,556	100	+ 4	+17

Canadian Gypsum Sales Show Increase For 1924

Revised statistics on gypsum production as reported by the dominion bureau of statistics under the authority of Thomas A. Low, show that the quantity of Canadian gypsum sold during 1924 was appreciably higher than in the previous twelve months. The total production for the year was 646,016 tons with a valuation of $2,208,108 as compared with 578,301 tons at $2,243,100 in 1923. The production was made up of lump, crushed, fine ground and calcined gypsum and there was also included the calcined gypsum used in the calcining plants for the production of wall plaster, wall board, alabastine and other gypsum products.

The average values received by operators were as follows: lump $1.81; crushed $1.82; fine ground $5.82; and calcined $10.27 per ton.

Compared with 1923, the imports remained constant while the exports, principally crude gypsum, increased approximately 75,000 tons to a total of 477,462 tons.

Monarch Cement Enlarges

With the addition of two super-synchronous motors the Monarch Cement Company of Humboldt, Kansas, expects to effect a saving in space allowing the installation of another tube mill without increasing the size of its building. The new equipment will consist of two General Electric 600-horse power, super-synchronous motors.

The Marion Steam Shovel Company has established direct factory branch warehouses and offices at 571 Howard Street, San Francisco, and 322 East Third Street, Los Angeles. At these points a complete line of replacement parts will be carried. Mr. Bert Engstrom and Mr. R. P. Ryan will be at San Francisco and Mr. John Harvey at Los Angeles.

New Vulcan Gasoline Locomotive

TO meet the prevailing demand for heavier gasoline locomotives, the Vulcan Iron Works, Wilkes-Barre, Pa., have recently developed a new 20-ton machine, to be known as their Model HS-20.

The builders have designed and constructed this locomotive very much along the same lines as their other heavy models. Steam locomotive practice is followed very closely in the chassis construction, the frames being of open hearth cast steel (open bar type), which affords long life and accessibility to all underneath parts. Springs are of elliptic type with cross-equalizing arrangement giving three point suspension. On standard gauge track, in shifting railroad cars—for which work this machine is primarily adapted—the locomotive is furnished with M.C.B. automatic couplers with spring buffer and draft rigging arrangement in the bumpers. This device takes up the shocks encountered in coupling and relieves the strains in pulling and pushing the heavy railroad cars, thereby protecting the motor and other working parts of the locomotive. The locomotive is mounted on four steel-tired driving wheels and is powered with a 6 cylinder, 125 H.P. motor.

The motor is a heavy duty industrial type with crank shafts of drop forged Chrome Nickel Steel, heat-treated and accurately machined as well as counter balanced, thus permitting the engine to run at a moderately high speed without undue vibration.

A built-in governor is provided, gear driven and well lubricated to guard the engine against overspeeding and racing. There is a centrifugal type water pump of ample size to provide proper cooling. It also has a forced feed lubricating system to the main, connecting rod and cam shaft bearings. All of the oil that is not consumed is drained back to a pump where it is strained and re-circulated. Proper oil pressure is maintained by a spring loaded pressure relief valve.

The ignition system is of the dual type from a high tension magneto with impulse coupling and a battery distributor with coil. Spark control of the two instruments is synchronized by a unique linkage mounted on the side of the magneto bracket and connected by a rod to spark control lever. Two spark plugs per cylinder are used; the magneto being connected to the spark over the intake valve and the battery distributor to the spark plug over the exhaust valve.

The motor is equipped with modern accessories, such as electric starter and generator, Stromberg Carburetor, and Storage Battery. Locomotive

The New 20 Ton Model HS-20 Vulcan Gasoline Locomotive

is provided with an oversized multiple disc clutch running in a bath of oil, providing for an easy and smooth starting of the load with very light pressure on the foot pedal, thus making pedalling very comfortable. The especially progressive action of this clutch avoids fierce engagement of sudden jerking and it has been conclusively proved to be the only one capable of long period slipping as part of its regular work, and at the same time assuring rapid radiation of heat without burning up the oil or buckling the plates.

The transmission is a perfect trouble-proof transmission that insures efficiency by completely eliminating gear clashing and the difficulties that grow out of gear shifting. By using constant mesh gears instead of the sliding type, speed changes are made quicker and easier without loss of acceleration to the locomotive. The speed changes are made by the engagement of indestructible jaw clutches. Gears, clutches and shafts are Chrome Nickel Alloy steel forgings properly heat-treated and hardened, thereby insuring long life and no replacements.

The final drive is by means of driving and parallel rods from cranks on the jack shaft to the crank pins in the driving wheels, traction being thus provided on all wheels.

The air equipment is of the straight air and automatic brake type, complete with air compressors, distributor valve, reservoirs, and all accessories. The air compressor is driven from a power take-off on the transmission and is provided with an automatic governor throwing the air compressor out of engagement when the pressure in the reservoir reaches a pre-determined point.

The cab on the standard gauge locomotive is built very wide to enable operator to take all train signals when handling wide box cars and other railroad rolling stock. All the controls inside the cab are conveniently located for the operator to manipulate without leaving his seat near the window on right side of cab.

The locomotive is designed for 4 speeds forward and 4 speeds reverse, geared from 2 to 15 miles per hour, with a maximum drawbar pull of 12,000 lbs. It has a comparatively short wheel base to negotiate reasonably sharp curves.

The Ottumwa Loader

The New Ottumwa Portable Handy Belt Loader is an efficient machine for loading box cars with sand and gravel, crushed stone, lime, cement, etc.

Roller and ball bearings are used throughout. A remarkably handy and quick raising and lowering device permits the loading of the smallest and the loading to capacity of the largest cars. The machine is equipped with the latest improved Alemite greasing system. All bearings and gears are inclosed to protect them from dust. The machine has a very low power consumption.

The Ottumwa Portable Handy Belt Loader

New Sand and Gravel Handling Equipment Book

A NEW sand and gravel handling equipment book has just been published by Link-Belt Company of Chicago, Indianapolis and Philadelphia.

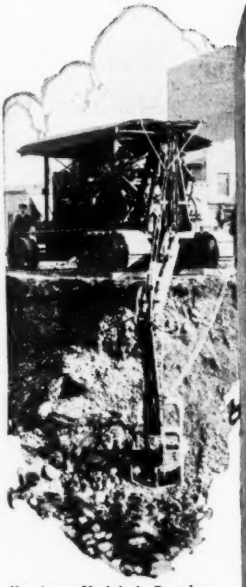
This book is intended for the use of those who are interested in the latest designs and the most modern methods used in the production of sand and gravel.

The fore part of this 72 page book is given over to the description and illustration of various types of screening, washing and handling equipment used in the preparation of sand and gravel, followed by photographs of typical installations operating under varied conditions.

Some of the best systems of washing are shown, as well as the application of elevators, belt conveyors, vibrating screens, crawler and locomotive cranes, and both drive and conveyor chains.

Take a Look at This List

of Reliable Manufacturers



Keystone Model 4 Crawler Gasoline Shovel equipped with Climax "Trustworthy" Engine.

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Brown Hoisting Machinery Co., Cleveland, Ohio
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Keystone Driller Co., Beaver Falls, Pa.
Link-Belt Co., Chicago, Ill.
Locomotive Crane Co. of America, Champaign, Ill.
McMyler Interstate Co., Cleveland, Ohio
Northwest Engineering Co., Chicago, Ill.
Orton & Steinbrenner, Chicago, Ill.
Osgood Co., Marion, Ohio

—when you need Hoists:

Lidgerwood Mfg. Co., New York, N. Y.
J. S. Mundy Hoisting Engine Co., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
O. K. Clutch & Machinery Co., Columbia, Pa.
Thomas Elevator Co., Chicago, Ill.

—when you need Gasoline Locomotives:

Davenport Locomotive Works, Davenport, Ia.
Fate-Root-Heath Co., Plymouth, Ohio
Mid-West Locomotive Works, Cincinnati, Ohio
Vulcan Iron Works, Wilkes Barre, Pa.
Geo. D. Whitcomb Co., Rochelle, Ill.

—when you need Ditchers:

Greiman Ditcher Co., Garner, Iowa
Parsons Co., Newton, Iowa

—when you need Paving Repairing Machines:

Equitable Asphalt Maintenance Co., Kansas City, Mo.

Whitcomb 12-ton Gasoline Locomotive equipped with Climax "Trustworthy" Engine.

—when you need Tractors:

Four Drive Tractor Co., Big Rapids, Mich.
The Kenison Mfg. Co., Solomon, Kans.
The Russell Co., Massillon, Ohio
J. T. Tractor Co., Cleveland, Ohio
Wisconsin Farm Tractor Co., Sauk City, Wis.

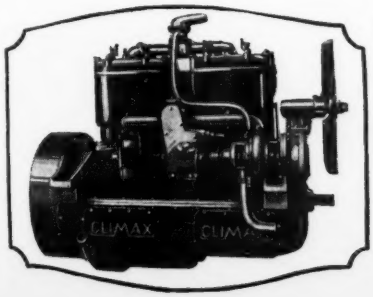
—when you need Power Drilling Machines and Oil Drilling Machinery:

Harry Pennington, Houston, Texas
W. T. Young Engine Co., Oil City, Pa.

—when you need Air Compressor Units:

Mundle Manufacturing Co., Peru, Ill.
Rix Compressed Air & Drill Co., San Francisco, Cal.

You can depend upon the performance of any machine of the above makes, because they are all equipped with Climax—The "Trustworthy" Engine. **Write for Catalog.**



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The "Trustworthy" Engine

Amsco Now Operating Sixth Foundry

A NEW foundry for the manufacture of Amsco manganese steel castings has just been placed in operation at Los Angeles, California, by the American Manganese Steel Company. This new plant is the most recently established unit of a country-wide chain of six foundries now owned by this company, the others being at Chicago Heights, Ill., New Castle, Delaware, St. Louis, Mo., Denver, Colo., and Oakland, Cal. The organization has facilities for producing about 25,000 tons of manganese steel castings annually and is the largest manufacturer in this specialized field.

The new Los Angeles foundry is of steel construction throughout, with corrugated iron roof and metal sash inside walls. It is thoroughly modern in all respects and equipped with an eye to the economical and efficient production of first class manganese steel castings.

In equipping the new plant, an effort was made to purchase locally wherever possible. The Union Iron Works fabricated and erected the building. The melting furnace is of the Moore type built by the Pittsburgh Eleltric Furnace Co. A Mahr furnace, car type, top-fired, is used for heat treating the finished castings, along with a quenching tank manufactured by the Western Pipe & Steel Co., of Los Angeles. Erection of this furnace as well as the core ovens and other furnaces was under the direction of E. W. Ekstrand, consulting engineer. Each furnace uses oil for fuel. A 300-ton Southwark hydraulic press for straightening has been installed, also a W. D. 12 type heavy duty General Electric welder for welding. The grinding equipment completes the facilities for handling the finished castings.

On the molding floor there are three jolt and squeeze International molding machines and in the core room two Herman jolt machines. These, with a Simpson sand mixer furnished by the National Engineering Co. of Chicago, aid in maximum production with minimum labor cost. Production will be aimed for at the rate of 100 tons a month. General equipment consists of the necessary machine tools for a mechanical shop and a 500-ft. Ingersoll-Rand compressor.

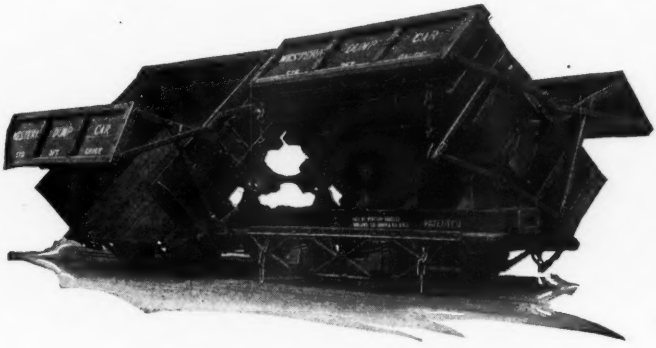
For a number of years, the American Manganese Steel Company has been making Amsco manganese steel castings by the electric furnace process at Chicago Heights, Ill., and Oakland, Calif. More recently, an additional foundry was acquired at Denver, Colo., where two 1½ ton electric furnaces especially adapted to the making of manganese steel, have been in operation for some time. In addition to the electric melting units, the Denver foundry has all the necessary heat treating plant, moulding and core-making equipment, modern cleaning, grinding and straightening machines and all else necessary to supply the Inter-mountain Region with excellent castings at reasonable costs. The complete layout for the manufacture of manganese and other electric steels together with an up to date iron foundry, makes this unit a very valuable asset to the users of these metals in that territory.

The foundry at New Castle, Delaware has also been completely electrified during the past few months, as regards steel-making capacity and otherwise, and this plant which has always been an efficient low-cost unit under older methods is in better position to serve its customers than ever before.

The company also operates another manganese steel foundry at St. Louis, Mo., under the name of the Southern Manganese Steel Company, which unit is also being equipped with electric furnaces so that before the end of the year the entire Amsco output of manganese steel will be manufactured by that process.

In addition to the above noted additions and improvements, there have been installed in 1924 at the largest plant at Chicago Heights, Ill. and will be installed in 1925 many additions of machining and other cost-reducing equipment so that this foundry, which is the largest one in the United States devoted exclusively to the production of manganese steel castings will remain in the forefront of progress and ability to serve efficiently the thousands of users of this metal.

Note The Strengthened End Construction



Western 4-yard, 5-yard, and 6-yard cars are built with reinforced end construction.

WISHING to make the already strong Western Dump Cars even stronger in order to maintain maximum production at pits and quarries, we now furnish Western 4-yard, 5-yard and 6-yard cars with a reinforced end construction, using steel angle bars and gusset plates. This is the kind of construction that led a steam shovel superintendent to say of the larger Western cars.

"They will stand more grief than any other dump car built."

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You can work them to the limit. They will keep both shovel and crusher producing.

Our Dump Car Catalog P-61 will tell you why. Please write to-day for your copy.

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Earth and Stone Handling Equipment
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"WE BUY—REBUILD—SELL OR RENT"

BUCKETS

78—Clamshell Buckets: 3—2-yd.; 2—1½-yd.; 23—1-yd.; 48—¾-yd.; 5—½-yd.; consisting of Standard, Blaw-Knox, Hayward, Owens, Lakewood, McMyler, O. & S. and Peerless.
5—Hayward Orange Peel Buckets: 1—¾-yd.; 1—1-yd.; 1—1½-yd.; 2—15 cu. ft.

CRANES

1—15-ton O & S, 8-wheel M. C. B., 40-ft. boom, bucket operating.
1—Brownhoist Combination Crane and Dragline, 40-ft. boom, ¾-yd. bucket, caterpillar, steam.
1—O & S 7-ton Crane, 30-ft. boom, ¾-yd. clamshell bucket, traction wheels.
1—Byers Auto Crane, 30-ft. boom, ¾-yd. bucket, traction wheels, steam.

STEAM SHOVELS

2—78-C Bucyrus late 1923 model 30-ft. boom. 19-ft. stick, 3-yd. dip. 1 on railroad trucks, 1 on caterpillar.
1—50B Bucyrus fully revolving on caterpillars, 26-ft. boom, 17-ft. stick, 1¾-yd. dipper, new November 1923.

LOCOMOTIVES

4—Porter 36-in. ga. 18-ton saddle tank cyls., 10x16, rebuilt like new. Nos. 4619, 4667, 6804, 6805.
1—Davenport std. ga. 20-ton cyls. 10x16 saddle tank. Shop No. 1747.
2—Porter, std. ga, saddle tank cyls. 14x22, weight 42 tons, like new, only 1 year service.

STEAM HOISTS

10—Three-Drum Hoists, with or without boilers. Sizes, 9x12, 9x10, 8¼x10, and 7x10, with separate swingers for derrick work. All makes.
60—Two-Drum Hoists, with or without boilers. Sizes, 12x12, 10x12, 9x10, 8¼x10, 7x10, 6¼x10, 6x8 and 5x8. Can be equipped with holding drum for bucket work. Several special Cableway Excavator or Drag Scraper Hoists. All makes.

DRILLS

4—Keystone well drills, sizes 3½ and 5½.
23—Ingersoll-Rand jack hammers.
5—Ingersoll-Rand Calyx drills.
3—Tripod drills-21R. 1-Sullivan.
14—Waugh Denver rock drills, model 21 and 31.

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Locomotives, Narrow and Standard Gauge, etc.

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All equipment repaired in our shop is furnished in guaranteed condition, subject to thirty days' trial in service.

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2—Erie B. Shop Nos. 143, and 1219, traction wheels, ¾-yd. dipper.
1—Type O Thew, Shop No. 1777, extra high lift, ⅝-yd. dipper, traction wheels.
1—18B Bucyrus, Shop No. 1870, traction wheels ⅞-yd. dipper.
2—70-C Bucyrus, Shop Nos. 1195 and 1197, 2½-yd. dippers.
3—70-ton Bucyrus Shop Nos. 939, 977 and 1233, 2½-yd. dippers.
2—60C Bucyrus, Shop Nos. 1286 and 1388, 2½-yd.
1—45-C Bucyrus. Shop No. 1202. Railroad type, 1¾-yd. dipper.
2—Model 60 Marion, Shop Nos. 1301 and 2238, 2½-yd. dippers.
1—Model 75 Marion, Shop No. 2112, 2½-yd. or 4-yd. dipper.
1—Model 80 Marion, Shop No. 1312, 4-yd.
1—95-C Bucyrus, Shop No. 1235, 4-yd. or 5-yd. dipper.

STEAM SHOVEL PARTS

1—Boom for Marion 60 or 61 Shovel, length 35 ft., 22-ft. dipper arm, 1½-yd. dipper, long jack arms, etc.

SIDE DUMP CARS

26—16-yd. Western Air Dump Cars.
23—12-yd. Western Air Dump Cars, 19-ft. beds, box girder doors.
31—12-yd. Western Air Dump Cars, 19-ft. beds, box girder doors, vertical dump cylinders, 60,000 lb. capacity trucks.
37—12-yd. Western Air Dump Cars, Truss-Rod Doors, 26-ft. beds.
4—12-yd. Oliver Hand Dump Cars.
12—8-yd. Western, 36-in. gauge, double truck cars.
7—5-yd. K. & J. 36-in. gauge Side Dump Cars, steel draw sills and steel lined wood beds.
8—4-yd. K. & J. 36-in. gauge, steel draw sills, box girder doors.
13—4-yd. Western, 36-in. gauge, steel beam cars.
42—4-yd. Western 36-in. Gauge Cars.
8—4-yd. Continental 36-in. Gauge Cars.

SPREADER CARS

1—Std. gauge Western Spreader Car.
1—Std. gauge 100,000 lb. capacity Jordan Air Spreader, Shop No. 503.
1—36-in. gauge Oliver Spreader Car.
1—36-in. Western Spreader Car.

LOCOMOTIVES—Standard Gauge

1—19x26 Baldwin 6-wheeled Switcher, with tender. Shop No. 48215. New 1918. Weight 62 tons. 180 lb. steam pressure.
1—19x24 Baldwin 6-wheeled Saddle Tank. Shop No. 49553, built 1918. Weight 67 tons, air brakes, 180 lbs. steam pressure.
1—18x24 Brooks 6-wheeled Switcher, with tender, Shop No. 1778. Wt., 50 tons.
1—17x24 Davenport 6-wheeled Switcher, with tender. Shop No. 1268. Steam pressure 180 lbs. Wt., 47 tons.
1—17x24 Schnectady 6-wheeled Switcher with tender. Shop No. 2956. Wt. 44 tons.
1—16x24 Porter 6-wheeled Saddle Tank, Shop No. 6065. Built 1918. Weight, 56 tons, 180 lb. steam pressure.
1—16x24 Vulcan 4-wheeled Switcher, with tender, Shop No. 1764. Steam pressure 180 lbs. Weight 40 tons.
2—16x24 Davenport 4-wheeled Switchers, with tenders. Shop Nos. 860 and 861. Steam pressure, 170 lbs. Wt., 38 tons.
1—13x18 American Saddle Tank. Shop No. 55248, built 1916. Wt. 32 tons.
1—11x16 Davenport 4-wheeled Saddle Tank Locomotive. Shop No. 1027. Wt. 20 tons. Steam brakes.

42-IN. GAUGE

1—11x16 Vulcan 4-wheel Saddle Tank. Shop No. 3085. Steel cab, A.S.M.E. boiler, 165 lb. pressure.

36-IN. GAUGE

2—11x16 Davenport Dinkies. Shop Nos. 2020 and 2027. New in 1925, used six weeks. Weight 21 tons.
1—11x16 in. Vulcan Dinkey. Weight 21 tons. New in 1922.
1—11x16 in. Davenport Dinkey. Shop No. 710. Weight 20 tons.
1—11x16 Porter Dinkey, Shop No. 6717. New in 1922. Wt. 21 tons.
2—10x16 Davenport Dinkies. Shop Nos. 1400 and 1417. Weight 19 tons.
4—10x16 Porter, 4 wheeled. Weight 18 tons.
1—10x16 Vulcan, 4 wheeled. Weight 18 tons.
2—7x10 Davenport, 4 wheeled, saddle tanks.
1—9x14 Vulcan Dinkey. Shop No. 1675. Weight 14 tons.

24-IN. GAUGE

2—7x12 Davenport Dinkies. Shop Nos. 1411 and 1524. Weight 9 tons.
1—6x10 Davenport Side Tank Dinkey. Shop No. 1307. Wt. 7 tons.

DRAGLINE EXCAVATORS

3—Class 24 Bucyrus Steam, Shop Nos. 3445, 3500 and 3671, skids and rollers, 85-ft. to 100-ft. booms; 3½, 4½ or 5-yd. Page buckets.
1—Class 20 Bucyrus, steam. Shop No. 813, skids, 85-ft. boom, 3-yd. Page bucket.
2—Class 14 Bucyrus, steam operated, either coal or oil burner. Shop Nos. 748 and 3706, caterpillars. 60-ft. booms, 2-yd. Page buckets.
1—Model 210 P & H, gasoline, Shop No. 1077, New 1920, 48-ft. boom, 1¼-yd. Page bucket, caterpillars.

CRANES

1—Type "B" Erie Crane, Shop No. 1219. 32-ft. boom, bucket-operating drums. ¾-yd. Williams clam shell.
1—10-ton Industrial, 4-wheeled. Shop No. 1989. 40-ft. boom, bucket operating.
1—20-ton McMyler, 8 wheeled, Shop No. 388, 45-ft. boom, 1¼-yd. O. & S. clam.
1—25-ton Browning. Shop No. 1560, 8 wheeled, 50-ft. boom, bucket operating.
1—Gantry Crane. New in 1919; 48-ft. boom, 15-ton cap. at 18-ft. radius; 7-ft. 10½-in. gauge, 12-ft. wheelbase, self-propelling. Base of boom 17 ft. above track. Bucket-operating drums. Wt. 50 tons.

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1—6x10 D.C., D.D. Lidgerwood Hoist, with 36x90-in. boiler.
1—6½x10 D.C., D.D. American Hoist, with butt strapped boiler.
1—7x10 D.C., D.D. Lambert Hoist, without boiler.
1—7x10 D.C., D.D. Flory Hoist, without boiler.
2—1½-yd. Page Dragline Buckets.
1—1½-yd. Brown Hoist Clam Shell Bucket.
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1—18B Bucyrus, revolving. Shop No. 1764. Traction wheels, ⅞-yd. dipper.

1—Type B Erie Revolving Steam Shovel, traction wheels, standard boom, ¾-yd. dipper.

1—Model 212 Marion (revolving). Shop No. 4620, New Sept. 1923, mounted on trucks, 55-ft. boom, 34-ft. dipper stick, 1¾-yd. dipper.

1—Model 28 Marion, standard revolving. Shop No. 2804, traction wheels, ⅝-yd. dipper.

1—Little Giant Railway type, standard gauge, equipped with standard boom, 1¼-yd. dipper.

CRANE

1—Northwest, Model 105, gasoline, standard caterpillar, 40-ft. boom, 1 yd. clam shell bucket.

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1—Class 24 Bucyrus, steam operated, skids and rollers, 100-ft. boom, 3½-yd. bucket.

1—Monighan 2-T Walker. Oil driven, 60-ft. boom. 2 cu. yd. bucket.

1—No. 2 Monighan, steam operated, skids and rollers, 70-ft. boom, 2-yd. bucket.

1—No. 2 Monighan, steam operated, skids and rollers, 80-ft. boom, 2-yd. bucket.

MISCELLANEOUS

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1—2-yd. Hayward Orange Peel Bucket.

1—3-yd. Hayward Orange Peel Bucket.

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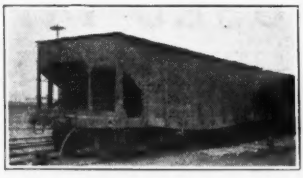

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2	75	G. E., type I, form M, slip ring.....	860
1	75	Fairbanks-Morse, type BV, slip ring..	690
1	75	G. E., form K.....	600
1	75	Westinghouse, type CW, slip ring.....	435
1	100	Westinghouse, type CS.....	870
1	100	Allis-Chalmers, slip ring, 2200 v.....	865
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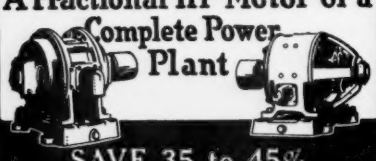

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1—No. 5 Austin.
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2—Davenport & Porter, 10x16, 36" gauge, 18 ton.
2—Davenport & Porter, 10x16, std. gauge, 18 ton.
1—American 10x16, 36" gauge, 17 ton.
1—Porter, 15 ton, 36" gauge.

SHOVELS

1—Marion Model 37, caterpillar.
1—Marion Model 36, caterpillar.
1—Northwest Model 105, gas, caterpillar.
2—Erie Type B, caterpillar and traction.
1—No. 0 Thew, traction.

CRANES

1—20 ton Orton & Steinbrenner, 8 wheel, std. gauge.
1—20 ton Browning, 8 wheel, ASME Boiler.
1—12 ton Orton & Steinbrenner, gas, caterpillar.
1—Northwest gas, caterpillar, with shovel attachment.
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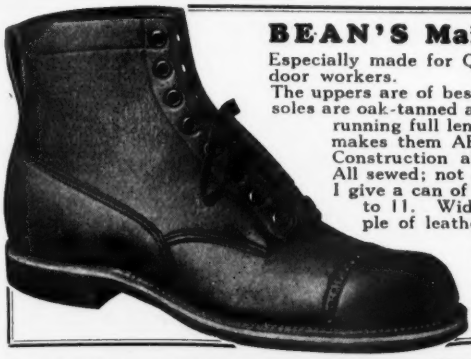

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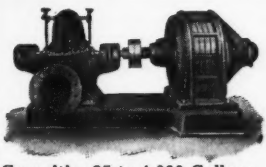

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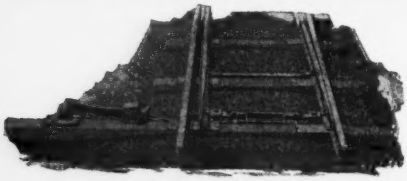

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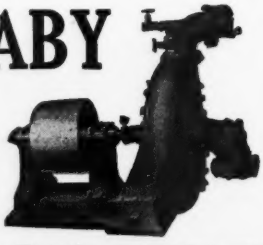

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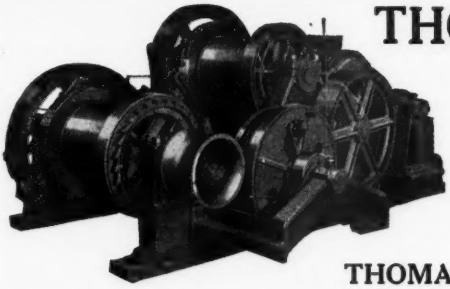

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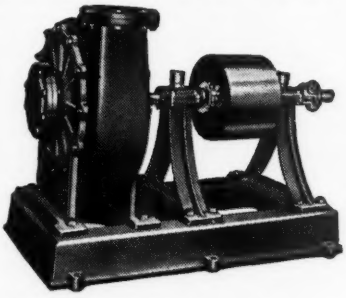

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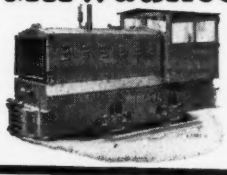

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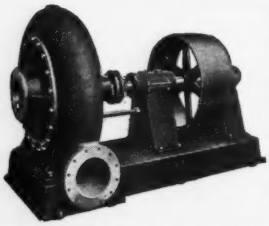

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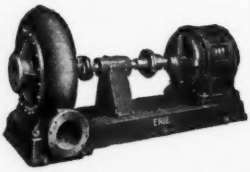

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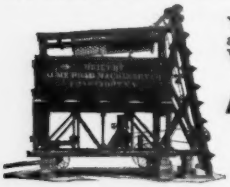

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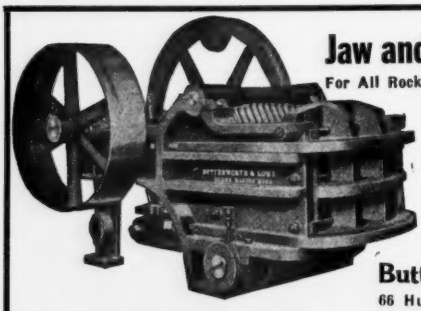

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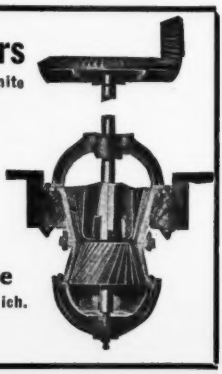

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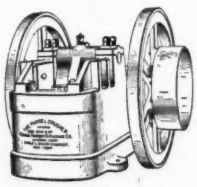

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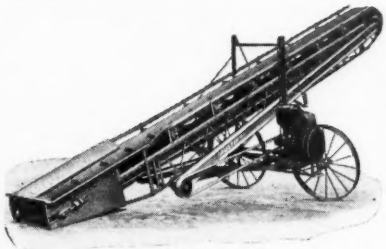

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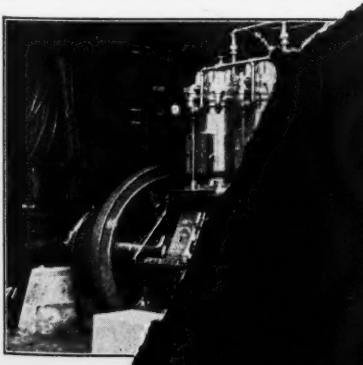

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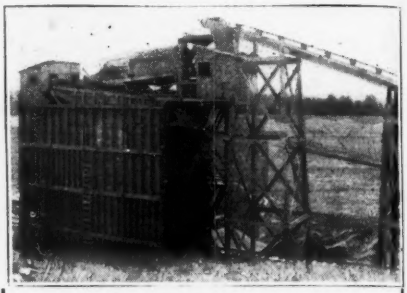

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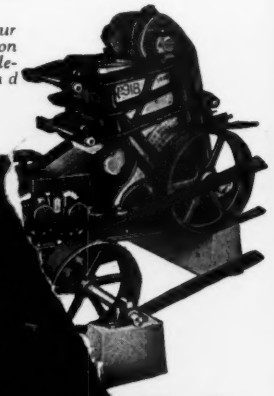

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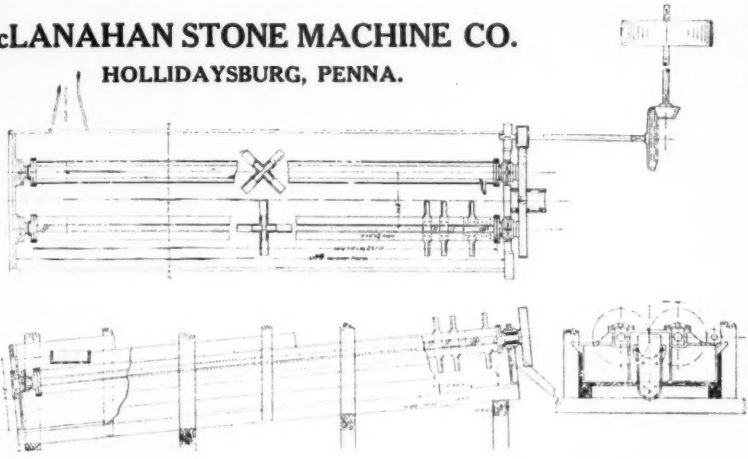

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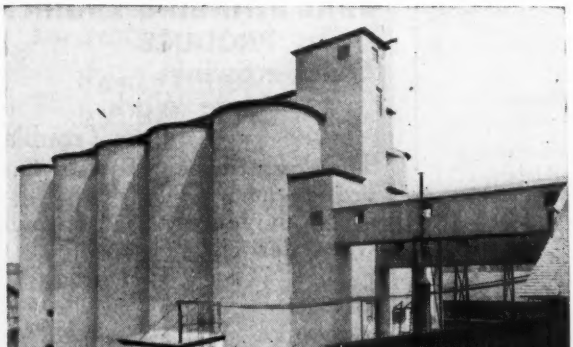

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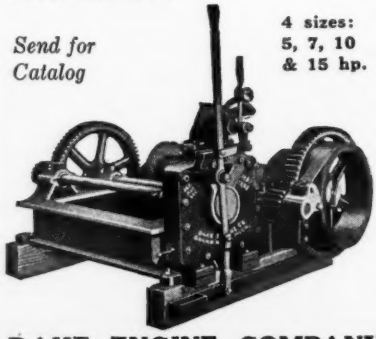

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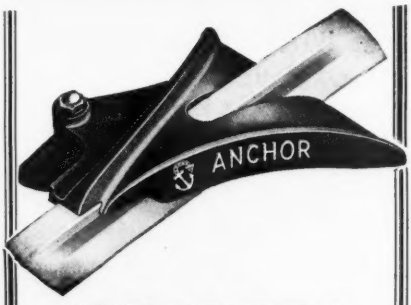

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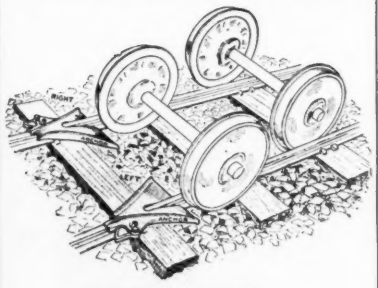

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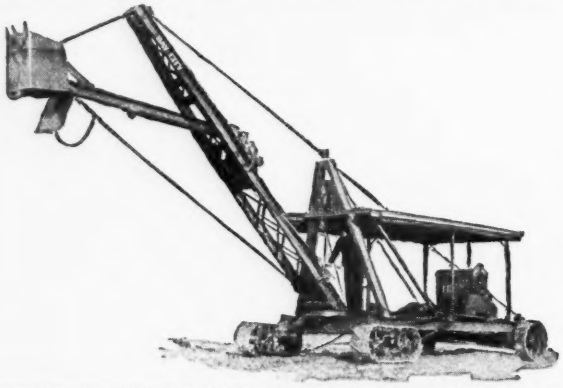
THE ORIGINAL SMALL SHOVEL

OPERATES ONE HALF YARD SHOVEL-CLAM-DRAGLINE



Shipped Assembled

Silent Chain Drive

Alemite Lubricated

Convertible

Caterpillar Mounted

Several Hundred in Operation

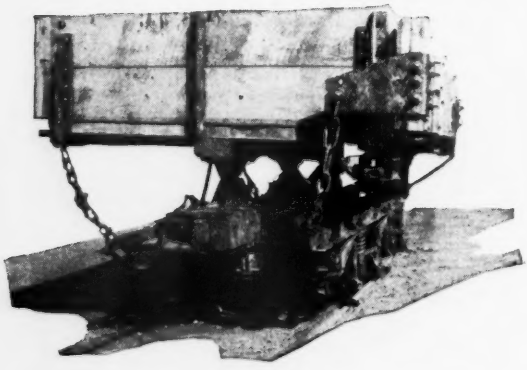
A STURDY ECONOMICAL MACHINE FOR STRIPPING OR LOADING

For larger jobs—the Bay City ¾-yd. 16B. Also Long Boom Bay Cities in 1 and 1½ yard capacities. There's a Bay City for every size plant. Several plants have purchased their 2nd and 3rd Bay City.

BAY CITY DREDGE WORKS **BAY CITY, MICH.**

See P&Q HANDBOOK Page 333

EASTON QUARRY CARS



Easton secures another patent of vital interest to all quarries.

This patent covers a door operating mechanism which is so simple in its construction that it can be readily and cheaply applied to any car of either the one side or both side dumping type.

Watch for further announcement.

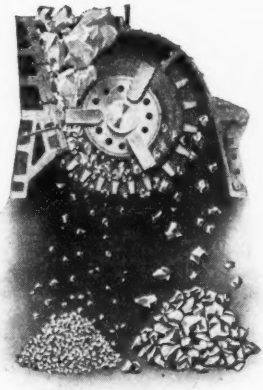
Easton Car & Construction Co.

Kansas City, Mo. **Easton Pa.**

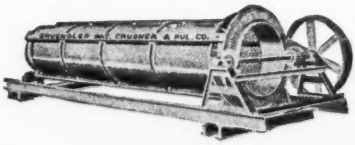
SALES OFFICES

New York, Chicago, Pittsburgh, Philadelphia, San Francisco.

Gruendler Service is Efficient, Productive and Economical—



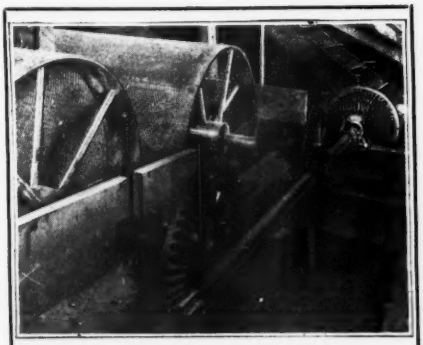
That is what operators say whose plants are Gruendler Equipped. Less labor, less equipment, greater tonnage, and uniform product are secured at lowest cost per ton. Gruendler crushers, revolving screens, elevators, hoists, and plant design have solved the producers' production problems.



Plants in any capacity from 3 to 6,000 tons daily. They are the result of experience and knowledge. Their exceptional ruggedness assures year 'round consistent performance with minimum upkeep.

Gruendler equipment and service will solve *yuor* production problems too. Consult with our engineers who will gladly analyze your crushing or pulverizing problem.

Gruendler Patent Crusher & Pulverizer Co.
908 North Main St.
ST. LOUIS, MISSOURI



Insured
Against Shutdowns

The installation pictured above shows a Foote IXL Reducer Operating Stone Screens in the Bellwood Quarry of the Central Lime & Cement Co., Hilsdale, Ill.

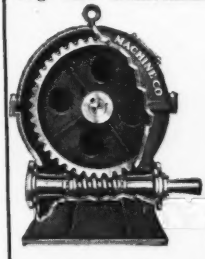
This is only one of the many uses found in the Quarrying Industries and Cement, Lime and Gypsum Plants for these compact, enclosed, safe, efficient Reduction Units.

For safe, dependable, economical and efficient service—you can always rely on

IXL SPEED REDUCERS

to drive screens, mixers, conveyors, elevators, pumps, mills, or any similar equipment.

Let us show you how IXL Speed Reducers will help you to cut your operating and maintenance costs.



Send for our Free Speed Reducer Book

N86

FOOTE BROS. GEAR & MACHINE CO.
235-245 N. Curtis St., Chicago, Ill.

FOOTE BROS. GEAR & MACHINE CO.
235-245 N. Curtis St., Chicago, Ill.

Signed .....

Address .....

CYCLONE NUMBER FOURTEEN BIG BLAST HOLE DRILLS

Whatever success Cyclone No. 14 Big Blast Hole Drills have attained in the quarry industry during the fifteen years of their existence has been due to close adherence to the following ideals and principles:

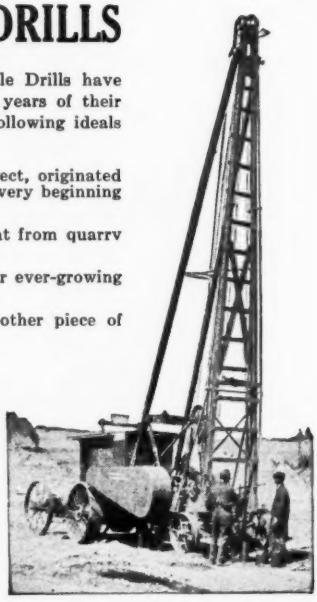
1—Starting with a design that was basically correct, originated after a close study of the requirements at the very beginning of the use of well drills in quarrying.

2—Always welcoming suggestions for improvement from quarry operators.

3—Keeping in close touch with the field and their ever-growing requirements.

4—Never holding the idea that a drill or any other piece of machinery could be perfect or faultless.

The story of the development of Cyclone No. 14 drills is completely told in our 100-page catalog B-45. It also contains 40 pages of cost and operating data on quarry drilling and blasting. Ask for a copy.



THE SANDERSON-CYCLONE DRILL CO.

Orrville, Ohio

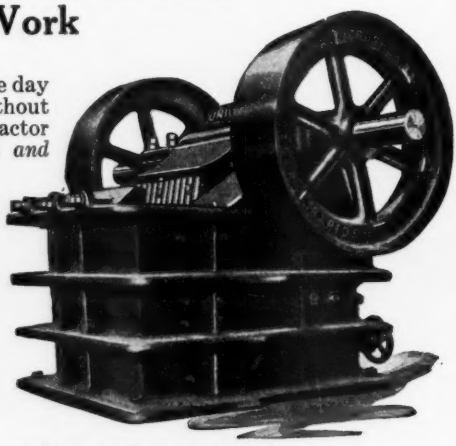
Eastern & Export Office:
30 Church St., New York City

UNIVERSAL CRUSHERS

Day after Day, The Year Around Universal Crushers Work

The crusher that will handle big tonnage day after day and do it economically without breakage and delays, is an important factor to consider. It means *bigger output and lower costs.*

All Steel frames combine strength and lightness. Six large opening general crushers with capacities to 450 tons per day. Six gravel and rejection crushers with capacities to 150 tons per day to pass a 1 inch ring. There is no stone too hard for these crushers.

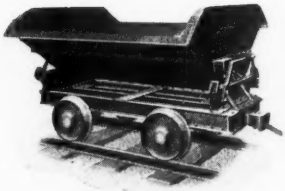


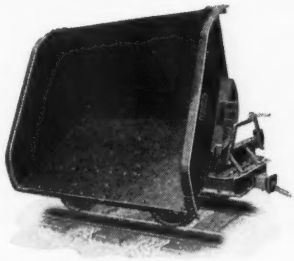
From more than 20 sizes we can recommend a crusher just suited to YOUR job. Either stationary or portable with or without elevators and power.

We serve the stone crushing trade everywhere.
Write us your requirements.

UNIVERSAL CRUSHER CO. 619 C. AVE. WEST CEDAR RAPIDS, IOWA

UNIVERSAL CRUSHERS





TIECO QUARRY CARS

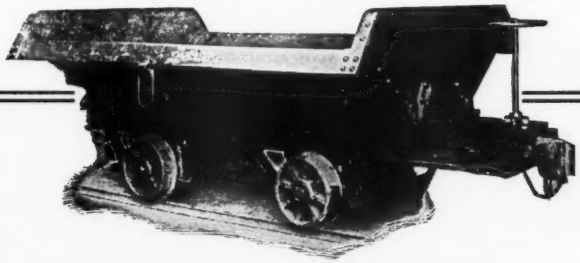
Built To Stand Up Under All Conditions.

There are no better cars built for quarry use than our type "Q" cars and price is no more than for inferior makes.

Frames of heavy ship channel, bodies of heavy steel plate, bronze bearings, all castings of steel.

Write for Prices and Literature

THE INDUSTRIAL EQUIPMENT COMPANY
MINSTER, OHIO



QUARRY CARS THAT ENDURE

Under Most Abusive Loading Conditions

ATLAS CARS are designed to reduce haulage costs and last longer

"They do both—Why not Investigate"

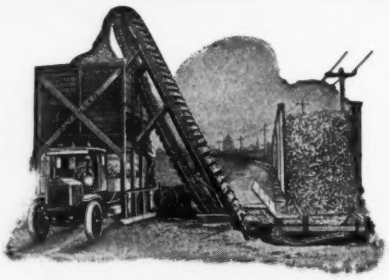
Engineering Service Especially Developed in Quarry Car Design

THE ATLAS CAR & MFG. CO.
1140 Ivanhoe Road **CLEVELAND, OHIO**

Quarry Cars, Rocker and Gable Bottom Cars, Special Cars of All Kinds

Here's What We GUARANTEE

When equipped with proper size feeder, the SUNBURY Automatic Unloader



Will load or unload a 50-ton car in 90 minutes!

***The* SUNBURY Automatic Unloader**

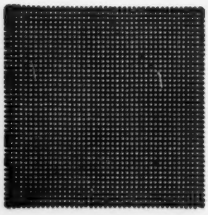
And one man can handle it. The first cost is reasonable and its return from the standpoint of its being able to substantially increase your profits makes it a very profitable investment.

Its automatic feature is important and will commend it to you. It is simple in construction, strongly built and economical in operation.

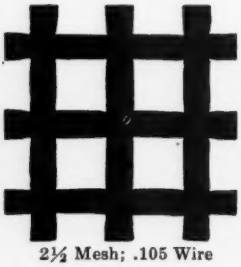
We will be pleased to send you an illustrated descriptive circular.

THE SUNBURY MANUFACTURING CO.

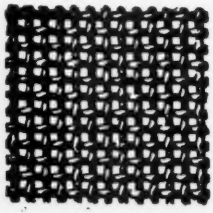
SUNBURY, OHIO



40 Mesh; .0135 Wire



2½ Mesh; .105 Wire



12 Mesh; .047 Wire

SERVICE! is the one thought behind every operation in the manufacture of—

"CLEVELAND" Double-Crimped Wire Cloth

Uniform fineness and long service will be assured by its use in screening SAND, GRAVEL, CRUSHED STONE AND CEMENT.

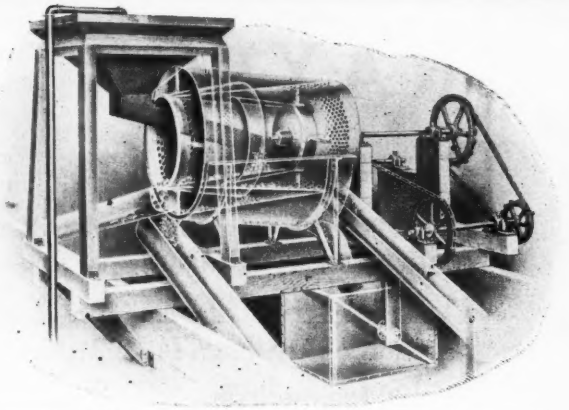
Large stock always on hand; special mesh manufactured to suit requirements at right prices.

THE CLEVELAND WIRE CLOTH & MFG. CO.

3579 EAST 78TH STREET

CLEVELAND, OHIO

Better Screening Because of This



Nest-O-Cone Screens have three distinct features that make them superior to other screens—that increase output without lowering quality. First—removal of oversize and coarse aggregate at the beginning of the screening operation gives greater feeding speed. Second—the change of direction of material flow through each screen provides better separation, prevents carry over and makes possible faster feeding. Third—the sand screen, being on outside of assembly, offers greatly increased screening area and therefore faster screening to finer materials.

Great reduction in installation cost is effected by the nesting of screen sections, which makes only one drive necessary.

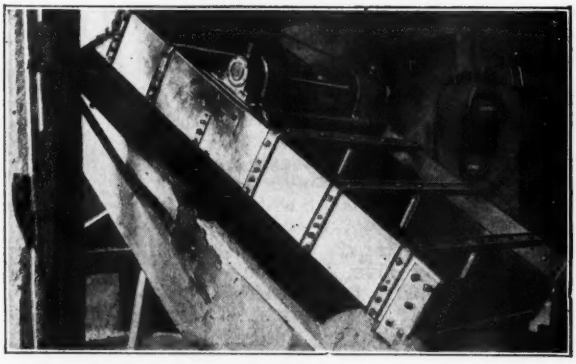
Write us for detailed information.

PIONEER TRACTORS, Inc.
WINONA, MINN.

Highest Efficiency

Largest Capacity

Lowest Maintenance Cost



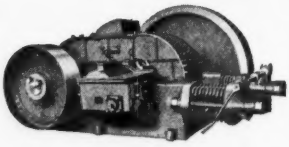
UNIVERSAL VIBRATING SCREENS have won the approval of producers thru their superior performance under the most difficult operating conditions.

Write today for catalog and prices

UNIVERSAL VIBRATING SCREEN CO.
RACINE ~ ~ WISCONSIN
See P&Q HANDBOOK PAGE 426

TRAYLOR

Crushing Rolls



are the most economical, easily operated, dependable rolls that can be secured.

The fleeting roll device prevents annular corrugation of shells and assures lowest steel cost per ton of product.

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Traylor Engineering & Manufacturing Co.
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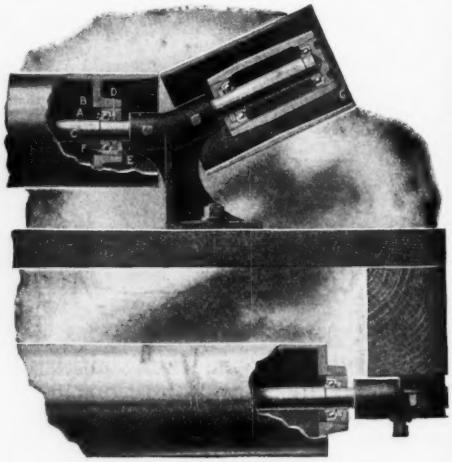
Eliminate Idler Friction with Conweigh Ball Bearing Idlers

More and more the demand in plant equipment is for intensive development and greater perfection in details. Conweigh Ball Bearing Troughing and Return Idlers represent a detail improvement which affects the whole conveying system of a plant. Because of the smooth, easy service they give, belt conveyors operate with far greater efficiency.

Conweigh Ball Bearing Idlers are smooth running, and durable, being made of hardened steel well reinforced. They give easy access for lubrication.

Get complete details on "Conweigh" Idlers. Made in all sizes. Write today.

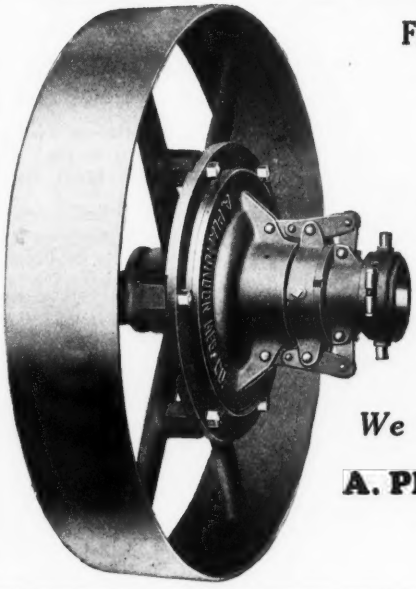
We are the original inventors and builders of belt conveyors equipped with ball bearing idlers.



Write for detailed information

THE CONVEYING WEIGHER COMPANY
90 West Street ENGINEER & CONTRACTOR New York

IMPROVED PLAMONDON



FRICTION CLUTCH PULLEYS
HEAVY WORKING PARTS
Now Made of Steel.

DEPENDABLE GEARS
CUT or CAST TEETH
STEEL or CAST-IRON
GENERAL MACHINE REPAIRS
PATTERN SHOP — FOUNDRY

We Can Give You Service

A. PLAMONDON MFG. CO.
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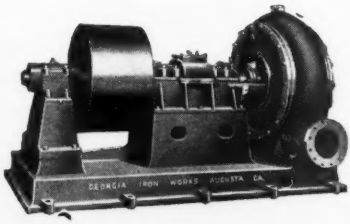
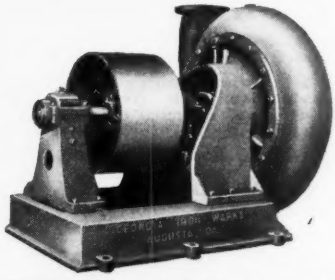


Heavy duty belt driven sand and dredging pump built in 8", 10", and 12" sizes.



Overhanging type belt driven sand and dredging pump. Built in 6" and 8" sizes.

SAND PUMPS

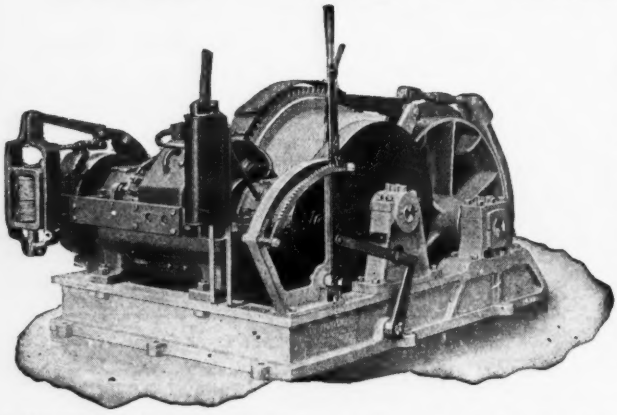
The accompanying cuts show two very popular types of belt driven units. These pumps are also built with bases for direct connection to motor.

Send for illustrated catalog showing our complete line of this equipment including flanged pipe fittings and hydraulic guns.

GEORGIA IRON WORKS
AUGUSTA, GA.
Established 1891

LIDGERWOOD HOISTS

Steam — Electric — Gasoline



Tell us what you w i s h in the hoist line.

We build types to meet every need in hoisting s e r v i c e.

S e n d f o r Catalogs.

O u r Engineers w i l l consult with y o u at any time.

LIDGERWOOD MFG. CO., 96 Liberty St., New York

Chicago; Pittsburgh; Philadelphia; Detroit; Los Angeles; Seattle; Tacoma; Portland, Ore.; Brown-Marx Bldg., Birmingham, Ala. **Sales Agents:** Norman B. Livermore, San Francisco; Woodward, Wight & Co., New Orleans, La.; John D. Westbrook, Inc., Norfolk, Va.; Canadian Allis-Chalmers, Ltd., Toronto. **Foreign Offices:** Sao Paulo, Brazil; Rio de Janeiro, Brazil; London, Eng.

Take the "Dirt" Out of Dirt Moving

Right now when stripping operations are slowing up under the heat is the time to install a Miami Fordson (one-man) Power Scraper. It never gets tired—never gets hot—but runs day in and day out, moving a minimum of 100 yards every ten hours on a two hundred foot haul, one way.

All this is accomplished by one man with one Scraper unit for less than twenty cents per yard.

Costs are slashed squarely in half with, this modern equipment. You will be surprised at the small initial investment, low depreciation and low operating costs.

Let us tell you more about it. Write today.

THE MIAMI TRAILER SCRAPER CO.

615 S. Clay Street **Troy, Ohio**

MIAMI FORDSON one man Power **SCRAPER**

Reg. U. S. Pat. Off.

DEPENDABLE "DOMESTIC" POWER UNITS

You may have good drills but don't forget this—

the compressor has much to do with the drilling efficiency of any drill. With a "Domestic" air compressor you are sure of the utmost from your drills. In many quarries Domestics are cutting the time and cost of drilling. And this difference means a difference of many dollars during a season's operation.

A 184 Cu. Ft. "Domestic" Air Compressor Mounted on Rubber Tired Trailer

You can have your "Domestic" Air Compressor mounted on steel truck, rubber tired trailer or ready to mount on truck chassis, in the following sizes: 50, 62, 92 and 184 cu. ft. displacement of free air per minute.

Send for a copy of Bulletin "MCP." It describes our line of Dependable Power Pumps, Hoists and Air Compressor Units.

Domestic Engine & Pump Co.

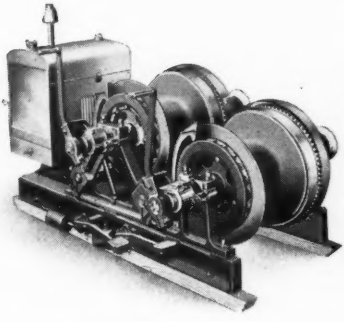
Manufacturers

SHIPPENSBURG, PENNA.

PUMPS—AIR COMPRESSORS—HOISTS

"O. & S." Gasoline Hoists

We build a Standard Line of Gasoline Hoists which are noted for their Reliability and Strength. They are built with Single, Double or Triple Drums and with or without Boom Swinging Attachment. These Hoists are built in six sizes, with a capacity of 425 to 5000 pounds on a single line.



Write for Bulletins Nos. 262, 269 and 270.

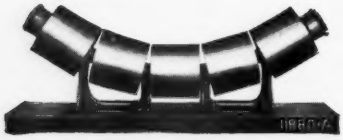
ORR & SEMBOWER, Inc.
READING, PENNA.

Established 1885

50 Church St.
NEW YORK CITY

208 N. Clinton St.
CHICAGO, ILLINOIS

Belt Conveyors



THE CALDWELL LINE

Power Transmission Machinery—Bearings, Pulleys, Gears, Chains and Wheels, Elevating and Conveying Machinery—Helicoid Conveyor, Chain Conveyors, Elevator Buckets, Boots, Casings, etc.

THE relatively light weight of the Caldwell Belt Conveyor, in proportion to capacity, makes it a desirable form to use where conveyor must be supported on trusses of considerable span.

This type of conveyor is also well suited, at shorter distances and slower speeds, for handling lime, cement, stone, etc., in bags; or in bulk.

Our experience and advice is at your disposal. Write or wire Caldwell, or the nearest Link-Belt Office.

H. W. CALDWELL & SON CO.

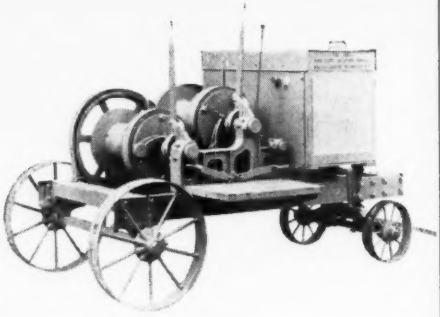
LINK-BELT COMPANY, OWNER

Chicago, 1700 S. Western Ave. Dallas, Texas, 810 Main St.

New York, 2676 Woolworth Bldg.

CALDWELL

Hoisting Strength without Excess Weight



Made of steel, portable and light, Ebel Hoists have the strength with but half the weight of cast iron hoists. Model B C weighing but 3,500 lbs. will handle a ¾ yd. Bottomless Scraper under any conditions.

We have Ebel Hoists that are ideal for Dragline, Elevators or for Pile Driving. Get in touch with us and get complete information. Also Bottomless Power Scrapers.

LANSING MOTOR & PUMP CO.

Home Office, 326 S. Hosmer St., Lansing, Mich.
Eastern Office, 302 Broadway, New York City

Send for this Book

EVERY SAND AND GRAVEL PRODUCER—those now operating and those intending to build new plants—will find something of real interest and value in this new 72 page Link-Belt book. It contains data of practical, every day use, and many illustrations and drawings which show the latest designs and most modern methods of economical sand and gravel production. Copies are now ready. Send for one.

2251

LINK-BELT COMPANY, 2045 Hunting Park Ave., Philadelphia, or 300 W. Pershing Road, Chicago. (Or Nearest Link-Belt Office)

Please send a copy of your new Book No. 540. (Pit and Quarry)

NAME ..... FIRM .....

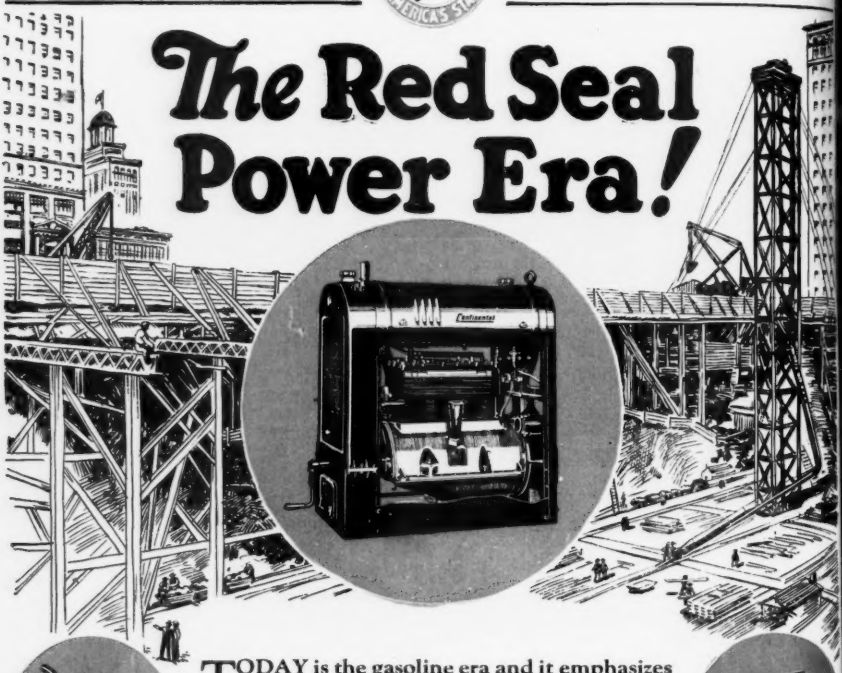
STREET and NO. ..... TOWN ..... STATE .....

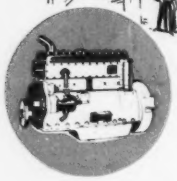
LINK-BELT

THIS YEAR LINK-BELT IS FIFTY YEARS OLD

DEPENDABLE POWER FOR EVERY PURPOSE

The Red Seal Power Era!

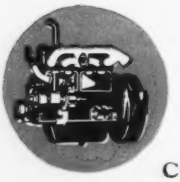


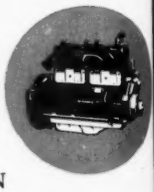


TODAY is the gasoline era and it emphasizes the outstanding leadership of Red Seal Continental Motors.

Likewise it is the Red Seal Power era for there is a Continental Motor for every purpose where power is employed. The Division of Industrial Engineering is daily cooperating with manufacturers of machinery in the selection of the correct motor to meet individual requirements.

Whether in a logging camp or mine, in oil field or isolated construction location, a Red Seal equipped product is never more than a few hours from one of the nation-wide Continental parts depots. This extra guarantee of continuous performance is just another reason why you should have Red Seal power.





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